SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

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FRIDAY, JUNE 12, 1903.

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

SECTION I., ECONOMIC AND SOCIAL SCIENCE.

II.

Is an Ideal Money Attainable? CHARLES A. CONANT, Treasurer of the Morton Trust Company, New York city.

Mr. Conant discussed some of the projects for doing away with money which have been put forward from time to time by students, and rejected them upon the ground that they ignore the true function of gold as a store of value and the most exchangeable of commodities. He declared that while large transactions could be cleared against each other without the use of gold, yet in the long run gold must be employed as the final test of value, because it was the one thing desired above all other things because it could always be exchanged for other things. Other things fluctuated in value according to their degree of exchangeability. This degree of exchangeability fell greatly where there was overproduction of goods, and it would be futile and unjust to take the values of goods, even over an average of time, as a proper measure of values. Gold money was the touch-stone of the need for goods. If they rose in price in gold it was an indication of unsatisfied demand; if they fell in gold it was an indication of overpro-

duction. Hence, the exchange value of gold in relation to each other thing was the governor of production and determined the direction in which capital should be employed. It would deprive society of any accurate means of determining the proper direction of capital, and the necessity for increasing or decreasing production of given articles, if it should be attempted to replace gold by a system of averages intended to give uniformity to prices without regard to the relation of demand and supply between different classes of goods.

Cooperation, Coercion and Competition: Professor Lindley M. Keasbey, Bryn Mawr College.

Industrial organization is determined by two factors, by the character of the social surplus, and by the monopolization of the sources thereof. History shows us three characteristic systems of industrial organization—the cooperative, the coercive and the competitive—which have succeeded each other in the order named. In the natural state before the appropriation of natural resources for pastoral and agricultural purposes, the cooperative system prevailed; during the proprietary period which followed, when natural resources were appropriated, but before the institution of exchange, the cooperative system became subservient to the coercive system, while with the rise of the commercial era, resulting from the development of exchange, the coercive system was superseded for some time by the competitive system. Present tendencies appear to point to a reversal of the original order of this succession. Owing to the gradual monopolization of the sources of the industrial surplus by the great capitalists, the older competitive system is breaking down. In its place the coercive system is being reestablished. But coercion when applied stimulates cooperation. The laborers are combining to resist the coercion of organized capital. If, as seems likely, capitalists and laborers cooperate in profit-sharing undertakings, then the consumers may possibly be coerced by the producers. It will then be necessary for the consumers to cooperate. Or to put the general thought theoretically, we may expect the present monopolization of the surplus sources to be extended gradually to admit laborers as well as capitalists, and finally, perhaps, some monopolies to be still further extended so as to admit consumers as well as producers.

Economic Work of the Weather Bureau: Professor Willis L. Moore, chief of Bureau.

In connection with the economic worth of the Weather Bureau the question is often asked, 'Does it pay?' I will cite a few facts in answer to that question.

The first year of the weather service the annual appropriation was about $20,000. This year that appropriation is $1,250,000, and congress and the people are plainly well satisfied with its expenditure. Our daily survey of the atmosphere is the largest attempted by any country or organization, and our system for the dissemination of warnings of severe or injurious weather conditions, such as storms, hurricanes, cold waves, frosts, floods, heavy rains and snows, is so complete that these conditions seldom occur without the country being notified well in advance. To give you some idea of the value of the storm warning service alone, I may say that there are 6,000 sailing vessels and as many steamers engaged in the trans-Atlantic trade, which leave our ports in a given year, and 17,000 sailing vessels and 4,000 steamers which annually ply between the ports on the Atlantic coast. Marine insurance people estimate that one West Indian hurricane, if it

were to sweep up the Atlantic coast unannounced, would leave wreckage to the amount of $2,000,000, without considering the loss of life. There has not been a storm of marked violence along the coast in the past eight years warnings for which were not issued from eight to twenty-four hours in advance of its approach.

Warnings of floods in the river valleys of the United States are also of great value. In the great flood of 1897 in the lower Mississippi valley, warnings were distributed over the inundated districts four to five days in advance of the flood, with the result that almost all of the movable property was taken to higher ground and saved. It is estimated that $7,000,000 worth of property was removed from the Yazoo valley alone on this occasion.

Warnings of those sudden temperature changes known as cold waves are of great importance. In January, 1896, a cold wave of exceptional severity swept over nearly the entire country east of the Rocky Mountains. Warnings of its approach were sent to nearly every weather bureau station in that region from twelve to twenty-four hours in advance. Information gathered systematically from shippers of perishable products and other interests affected disclosed the fact that the warnings resulted in the saving of over $5,500,000 in the protection of property from injury or destruction.

The frost warnings recently issued for Florida, when the temperature in the northern part of the state fell as low as 20° to 24°, and frost formed as far south as Tampa, resulted in the probable saving of hundreds of thousands of dollars to the truck interests of that state.

These are but a few instances of property and money values saved, and they give a very incomplete idea of the full economic value of the Weather Bureau forecasts and warnings to the interests of the country. The work of the bureau in the collection and publication of data and the issue of forecasts and warnings affects the daily life of the people to a very great extent, and becomes an important factor in their various avocations and business enterprises.

Economic Work of the Bureau of Animal Industry: Dr. D. E. SALMON, chief of Bureau.

The Bureau of Animal Industry is required by its organic act "to investigate and report upon the condition of the domestic animals of the United States, their protection and use, and also inquire into and report the causes of contagious, infectious and communicable diseases among them, and the means for the prevention and cure of the same, and to collect such information on the subjects as shall be valuable to the agricultural and commercial interests of the country."

Since the organization of the bureau, however, it has been given from time to time a great amount of executive work, and this now largely exceeds the investigations which constituted the original object of its establishment. Thus it is expected to control and stamp out the contagious diseases of animals which are dangerous to interstate or foreign commerce; to prevent the introduction of diseases from foreign countries by an inspection and quarantine of imported animals; to inspect and certify to the healthfulness of exported animals; to supervise and control the fittings of steamships which carry our animals to foreign countries; to inspect the meat slaughtered for interstate or foreign commerce; and to inspect and certify to the quality of dairy products that are exported.

This brief summary will give an idea of the scope of the duties of this bureau under existing laws.

The first great task was to establish what is known as the Texas-fever line, which now extends from ocean to ocean and serves to divide the section of the country in which the disease originates from that in which its ravages are usually seen. This line needs constant rigid supervision to prevent the spread of the infection. It involved last year the inspection of 1,545,000 cattle and the cleaning and disinfection of 46,736 railroad cars.

The wisdom of establishing the bureau is attested by the successful eradication of the contagious pleuro-pneumonia of cattle from this country, at a comparatively small expense; by the development of a single vaccine for blackleg, which has been used upon millions of cattle and has reduced the losses in infected herds of cattle to less than one per cent., thus saving many millions of dollars to the cattle industry; by the development of a federal meat-inspection service which last year inspected at the time of slaughter 38,829,439 carcasses, insuring healthy meat to domestic consumers and enabling the government to certify to the wholesomeness of that which is exported; by its successful control over the exportation of live animals, a trade embracing 300,000 to 400,000 cattle and 200,000 sheep a year, and which has done away with all unnecessary suffering aboard ship and reduced the losses to 0.13 per cent. with cattle and 0.89 per cent. with sheep; by the successful investigation of many diseases and the dissemination of a vast amount of information relative to the breeding and management of domesticated animals in health and disease.

These are only the principal lines of work undertaken. Every outbreak of disease which is supposed to be contagious is promptly investigated, and in case any are found dangerous to the animal industry of the country the proper measures are applied. Scientific researches are constantly conducted and are throwing new light on the nature of diseases and the means applicable for their control. The objections raised in other countries to our animals or animal products are carefully watched, and the causes removed when well founded, or explained when they are brought with a misunderstanding of the facts.

Economic Work of the Bureau of Plant Industry: Professor B. T. Galloway, chief of bureau.

The organization of the Bureau of Plant Industry was first described. It was pointed out that the general policy of the bureau is to give the broadest opportunities to its individual workers, recognizing the fact that the best results can be accomplished by giving to each individual such responsibilities as will lead to the strongest development of both the man and the work. The bureau's work is handled by problems rather than by groups of subjects. It was pointed out that while the object of the bureau's work is practical in all things, the policy is to encourage scientific research in every way, it being recognized that scientific investigation is the basis for all applied work. The work of the more important branches of the bureau were then briefly reviewed. Examples of the methods of handling plant diseases were given, showing the relation of laboratory research to the securing of practical results in the field. Various methods of handling diseases of crops were described. Treatments by direct remedial measures were discussed; treatments, or preventions, by the securing or creation of immune sorts, were described, and the other methods followed in this line of work were brought out. The work in physiology was described, especial attention being given to the results obtained in the laboratory investigations on nitrifying organisms. The

economic bearing of the plant-breeding investigation was shown. The efforts being made to increase the protein content of corn, and the creation of new varieties of corn for special purposes, were described in detail. Some of the new creations in the matter of fruits were also discussed. The work of the bureau in the matter of foreign explorations for the purpose of securing new plants for use in this country was described. Finally there was given an outline of some of the important work of the botanists in the matter of investigating poisonous plants, and the results accomplished in finding antidotes where the injuries to stock, through the eating of such plants, had proved serious.

Economic Work of the Bureau of Chemistry: Dr. H. W. WILEY, chief of bureau.

The science of chemistry is the first mentioned in the organic act creating the Department of Agriculture. Chemistry, botany and entomology were the three fundamental scientific divisions recognized in the establishment of the department. And the chemist was the first man appointed to investigate the economic problems relative to agriculture in which chemistry is concerned. I will try to give you some idea of the extent and character of this work. In 1886 as vice-president of Section C at Buffalo I gave an address on 'The Economic Aspects of Agricultural Chemistry.' So you have on the records of this association what I have to say on the subject. There has been little change, and I can only offer illustrations and use data not then available. In the first place, chemistry has established the principles of scientific crop feeding. The business of fertilizing in this country has grown enormously. Until twenty-five years ago fertilizing was altogether empirical. When a farmer had any fertilizer to use he spread it all over his fields and used the same kind for all parts of his farm. The patches which yielded the poorest were of course most treated. He had no idea of what was needed or how it should be used. When commercial fertilizers came into vogue many were of poor character and some farmers were rather badly cheated. However, the general effect was good and lands in almost every state in the union have increased in value in consequence of the adoption of the principles laid down by agricultural chemistry. Much better results may yet be obtained when the needs of the soil and plant life are given more attention by the farmer. The researches of agriculture in plant life show often that only certain elements essential to plant growth are lacking in a particular soil, and that others, not always present elsewhere, can be found here in abundance, so that some constituents of the ordinary fertilizer may be left out and others should be present in even greater quantities. It is not necessary to supply a complete fertilizer for each field. The needs of the field should be determined beforehand, and this the agricultural chemist is doing. The great problem is not only how to conserve fertility, but how to increase it when it has been diminished. There is no reason to believe that there will be any reduction in the ratio of the food supply to the population. The former will increase as rapidly as the latter. I might refer to the address of Sir William Crookes a few years ago before the British Association for the Advancement of Science, in which he looked forward to a period about thirty years hence, when humanity would begin to suffer very seriously from a lack of land of the proper productive capacity to feed all of us, until finally there would not be enough food to go around. There is no

longer ground for such fears. The productiveness of the soil will keep pace with the increase of population. When it is necessary to produce 1,000,000,000 bushels of wheat annually in this country it will be forthcoming. The part of the doctrines of Malthus which holds that the food supply can not be made sufficient to maintain the increasing population as the years go by, in my opinion, is absolutely groundless. The food supply will always be sufficient, but that supply must depend largely upon the researches of agricultural chemistry. The farmer to-day can prepare steers for the market at one third less cost than he could twenty-five years ago, because he knows how to balance the rations in the right proportions. He also knows how to bring his stock into the market at an earlier period and thus effect another great saving. The cost of feeding farm animals to-day is only about two thirds what it would be had not the principles of science been applied to raising stock on the farm. After a while perhaps we will be able to study the scientific feeding of man. He is an animal too, you know. If we want a man to be an athlete we feed him in a certain way, and so the time is not far distant when we must learn to feed all kinds of men for the markets just as we do the other animals. And so economy will come in the feeding of men as well as in the feeding of what we are pleased to call the lower animals. We shall save at least one third and shall still have as much as is good for us.

Here is another way in which the principles of agricultural chemistry will prove of economical value. I refer to the idea of securing elements necessary for the growth of the plant from the nitrogen in the air. It has been suggested that the nitrogenous material now in the soil is insufficient for a very great period. But it may be augmented yearly by the floods of which Professor Moore has spoken, by damming rivers, etc., and the use of water power thus secured for converting the nitrogen of the air into forms available for plant nutrition, by electrical means. This, with the nitrogen already available, is more than enough for present and future needs. With a sufficient food supply for the present we can look with complacency upon our rapidly increasing population, and rely on agricultural chemistry for all additional food needed.

Economic Work of the Bureau of Soils: Professor Milton Whitney, chief of bureau.

The Bureau of Soils of the United States Department of Agriculture was organized as a part of the Weather Bureau about eight years ago. Since its organization it has been separated from the Weather Bureau and reorganized into an independent division, and later into a bureau, its rapid growth in size, scope and efficiency having been remarkable. One of its most important lines of work is the soil survey which, while not in itself immediately productive, really constitutes a more intelligent basis for the development of other economic work in agriculture than has hitherto been available. In the strenuous competition for agricultural supremacy existing between different countries, states and individuals, a thorough knowledge of all factors bearing on agriculture is essential. The soil is one of these factors, just as climate, insects and plant diseases are others.

As an illustration of the economic value of the soil survey work may be mentioned the introduction of Sumatra tobacco in the Connecticut valley. A soil survey made in that valley in 1899, showing the distribution of the different soils, disclosed a soil producing a leaf which was the closest approach to the Sumatra wrapper. While

the Connecticut tobacco then brought an average of twenty cents per pound, the imported leaf commanded from $2.50 to $5 per pound. By growing Sumatra seed under cheesecloth tents, erected at a height of nine feet over the entire field, this covering modifying the climatic conditions, and with radical changes in the methods of cultivation and fermentation, a wrapper leaf has been produced equal at least in all respects to the imported article. This past season 700 acres have been grown, the product of which is valued at $1,000,000, bringing on an average from $1.50 to $3 per pound, compared with twenty cents per pound for the ordinary Connecticut wrapper; and an industry has been established which will pay 100 per cent. and over on the investment. Capital is attracted by reason of the fact that a large expenditure can be made on a small area with large returns, or on a larger area with proportionally large profits. An expenditure of $650 per acre yields a return of 100 per cent. or more over and above all expenses. This is a productive industry that has been developed by the bureau, and which is attracting the investment of enormous sums of money.

Another illustration is in the discovery of a soil in Texas which will produce a leaf possessing all the desirable qualities and aroma of the Cuban product. These lands are entirely undeveloped, principally uncleared and practically valueless for other crops, yet tests of the leaf produced, made by experts, show it to be far superior to any of our domestic filler tobacco.

A soil survey made in the Yazoo delta, Mississippi, has brought attention to a soil which, covering enormous areas, has heretofore been regarded as absolutely worthless, but which with a slight expenditure for protection from overflow would produce from $200 to $1,000 per acre, being particularly adapted, by reason of fertility and climatic and market facilities, to trucking.

Another line that has been productive of useful results has been the study of alkali soils of the west. It has been thoroughly demonstrated by practical experiments of the bureau that excessive alkali may be removed by drainage, and thousands of acres of land now worthless may be reclaimed and made productive. A careful study and practical experiments are now in progress, and already the success achieved has thoroughly demonstrated the success of these operations.

Economic Work of the Office of Experiment Stations: Dr. A. C. TRUE, director, Office of Experiment Stations.

This office is so related to the agricultural colleges and experiment stations as to constitute a general agency for the promotion of agricultural education and research. On the economic side, the agricultural colleges, chiefly through their research departments called experiment stations, are doing a large and successful work directly for the improvement of agriculture, by increasing the amount of production and at the same time raising its quality through the application of science to agriculture. But it is on its social or educational side that the experiment station movement is destined to exert its most profound and permanent influence. For the scientific researches of the stations and their application to agricultural practice not only provide much material for effective courses of instruction in the theory and art of agriculture, but they also furnish to the farmer the hitherto lacking motive for definite technical education along the lines of his art. This is changing the intellectual attitude of the farmer from conservatism to progressiveness. If, as now seems likely, the stations and the Department of Agriculture shall erelong succeed in arousing the mass of

farmers to a progressive attitude of mind, and put the center of interest of the vast and fundamental industry, agriculture, in the future, they will accomplish a work of incalculable importance—a social revolution the like of which has never before been seen. This subject is well worth the earnest consideration of students of economic and social science. The important thing to note here is that it is the present policy of the Department of Agriculture to aid broadly in the education of the farmer along the lines of agricultural science, in the belief that the broadening and deepening of the intellectual life of our rural population are as important, to say the least, as the improvement of their material conditions.

The Office of Experiment Stations promotes the general interests of the American system of agricultural education and research in several ways: (1) It collects and diffuses information regarding the progress of agricultural science the world over through a monthly journal called the *Experiment Station Record* and through numerous technical and popular bulletins; (2) it seeks to formulate the principles on which institutions for agricultural research should be organized and managed, and exerts its influence to secure the practical application of those principles in the management of the state experiment stations; (3) it aids the movement for the technical education of the farmer by encouraging the formulation of a distinct science of agriculture and its reduction to 'pedagogic form'—to meet the requirements of different classes of students. It is now especially promoting the establishment of secondary courses in agriculture and the extension of farmers' institutes.

Besides its general functions, the office has at present certain special duties. It has organized and directly manages agricultural experiment stations in Alaska, Hawaii and Porto Rico, and in cooperation with agricultural colleges, experiment stations, state officials and private organizations in different parts of the country, it is conducting investigations on the food and nutrition of man and on irrigation.

Its nutrition investigations have a broad economic bearing as affecting the food habits of our people and as contributing to the scientific basis of the teaching of home economics in our schools and colleges.

Its irrigation investigations deal with the laws and institutions of communities whose agriculture is wholly or in part dependent on irrigation, and treat of social and economic problems of fundamental importance to such communities.

The office is also beginning studies regarding the use of various kinds of power in agriculture and other subjects in the domain of agricultural engineering, hoping to lay the foundation for a broad treatment of this hitherto neglected branch of agricultural science by the department.

Economic Work of the Division of Entomology: Dr. L. O. Howard, chief of Division.

The work of the Division of Entomology is to investigate insects directly or indirectly injurious to man, and to endeavor to lessen the damage which they bring about. It also includes an investigation of beneficial insects. It has been estimated that insects injure the agriculture of the United States to an extent of more than three hundred millions of dollars annually, and it is further estimated that were it not for the continued investigations and suggestions of economic entomologists, this money loss might any year reach the sum of four hundred and fifty millions to five hundred millions of dollars. The sum expended by the government for investigations of this character, whether under the

state agricultural experiment stations or under the Department of Agriculture, amounts to less than two hundred thousand dollars annually. Public interest in this work and confidence in the recommendations of entomologists is growing. This means that the service is being encouraged by larger appropriations. When the speaker came to Washington twenty-five years ago four thousand dollars was appropriated for this work, which was carried on by two men; now nearly one hundred thousand dollars is appropriated and about twenty-five scientific experts are employed. The work is well systematized and is being carried on under the following heads:

1. Field crop insect investigations, including a southern section which comprises the insects injurious to cotton, tobacco and sugar cane, and a northern section which investigates the species damaging cereals and forage plants.

2. Fruit insect investigations, with a northern section devoted to the deciduous orchard fruits, and a southern section which cares for citrous and other tropical fruits.

3. Small fruit and truck crop insect investigations.

4. Forest and forest-product insect investigations.

5. Insecticide and insecticide machinery investigations, which include a section of field operations and experiments and a section of chemical analyses and tests.

6. Investigations of insects affecting stored products, such as cereal, animal and other food substances, materials and fabrics of all sorts.

7. Investigations of insects in relation to diseases of man and other animals, and as animal parasites. The enormous importance of mosquitoes in relation to malaria and yellow fever, and of flies to typhoid, has drawn very general popular attention toward this phase of the work.

8. Special insect investigations, which include a section for the investigation and introduction of beneficial insects, a section for the study of fungous and other diseases of insects, and a section for emergency and unclassified work.

9. The conduct of an insect laboratory and the care of collections, as well as the care of an experimental garden.

10. Investigations in bee culture.

11. Investigations in silk culture.

The speaker, with some little detail, described some of the operations carried on under these respective heads, and dwelt especially upon the work now being prosecuted in Texas against the Mexican cotton boll weevil, an insect which has caused a money loss to Texas cotton planters, during the past three years, of approximately seventy-five millions of dollars. He showed that this insect may be practically handled by simple variations in the cropping methods in use in the state of Texas, and described certain large-scale demonstrations which have been carried on during the past year upon farms of 150 and 200 acres, respectively.

He also spoke especially of the introduction of a fig-fertilizing insect from Algeria which has rendered possible the cultivation of the Smyrna fig in the United States, and also of the recent introduction of a lady-bird beetle from China which feeds upon the San José scale.

Economic Work of the Biological Survey: Dr. C. HART MERRIAM, chief of Division.

The Biological Survey comprises three independent sections: The Biological Survey proper, which studies the geographic distribution of animals and plants and determines the boundaries of the life zones and crop zones; the section of economic ornithology, which studies the food and

food habits of birds with respect to agriculture and horticulture; and the section of game preservation and introduction, which has jurisdiction over matters covered by the provisions of the Lacey Act, and also of the game laws for Alaska.

The Biological Survey proper carries on field explorations in all parts of the country, but does most of its detailed work in the west. It collects data and prepares maps showing the actual distribution of various species of mammals, birds, reptiles, trees and shrubs, and determines the boundaries between the several life zones and areas. By a study of the associations of species distinctive of the several zones in connection with the crops found to thrive best in parts of these zones, it prepares lists of the particular varieties of fruits and other agricultural products adapted to each belt.

The section of economic relations, by studying the food habits of birds in the field, and the stomach contents of birds in the laboratory, determines the economic status of various species of importance from the standpoint of practical agriculture. Birds are studied by species and groups, and an effort is made to ascertain the food of each species during each month in the year and from different parts of the birds' range throughout the United States, so that the results arrived at may be authoritative and final. Among the groups thus far treated are the hawks and owls, crows, blackbirds, orioles, cuckoos, shrikes and sparrows.

The section of game protection and preservation inspects importations of live birds and mammals from foreign countries in order to prevent the introduction of noxious species, such as the mongoose, the large fruit-eating bats, the starling, kohlmeise, and others, and gives permits for the introduction of non-harmful species. It has charge, also, of matters of federal game protection and the interstate commerce in game shipped in violation of state laws. It publishes digests of the state game laws and laws for the protection of birds other than game birds, and other literature bearing on the general subject of game protection.

The Economic Value of the Remaining Public Land: J. D. Whelpley, Washington, D. C.

The land office of the United States has had under its control for disposal under such laws as have prevailed from time to time an area probably amounting to about one billion five hundred million acres of land. About one billion acres of this land have passed from government to private ownership. About five hundred million acres remain subject to the law of congress.

The economic value of the one billion acres which have already been disposed of has been fully demonstrated. The world power of the United States as a nation has become great in direct ratio to the development of the natural resources of the public lands. The tremendous increase in wealth resulting from the rapid settlement of the one billion acres of public land has blinded the people of this country to the serious defects which have existed in the laws governing the disposal of the same.

Not one hundred million acres of the five hundred million remaining are suitable to profitable and comfortable occupation by American citizens under existing economic, physical and social conditions. It is now generally recognized that it is of supreme importance that the government should intelligently conserve the possible economic values of that area of the United States which is still included within the limits of the public domain. Room is needed for more population, more raw material is necessary to maintain our manufacturing industries, and one homesteader

and his family settled happily upon 160 acres of carefully tilled land is worth more to the industrial, commercial, transportation and social interests of the country than the non-resident ownership of a range industry covering many thousand acres.

Every Secretary of the Interior for twenty-five years past has recommended a curtailment of the land privilege. Congress has responded in some degree to this demand, but there is immediate need of radical changes in the laws now upon the statute books. Not another acre of the public lands should be sold for cash or its equivalent. Residence and cultivation should be required before title could be obtained, and this residence and cultivation should be at least five years, so as to insure a permanent and not speculative interest in the holding. The desert-land law and the commutation clause of the homestead act should be repealed, for while there may be isolated cases produced in evidence of the alleged beneficial character of these laws, a vast majority of the land acquired under these filings is for other than the legitimate purpose of settlement, occupation and general development of the country.

In 1902 about twenty million acres were taken from the public domain under the various laws now on the statute books. It is estimated that there will be nearly twenty-five million acres appropriated in 1903. In 1901 there were but sixteen million, and yet at that time that figure was considered enormous and alarming. Those who are building up large land holdings in the west realize that public sentiment is aroused, and they are crowding in every direction to secure title to as much land as possible before congress takes this matter in hand.

It has been argued against the repeal of these laws that the fund created by the national irrigation law from the sale of public lands would be destroyed. In the first place, if these laws were repealed today and existing rights allowed to be perfected there would probably be about twenty million dollars in the reclamation fund. The government would reap an enormous profit on the investment, even if it were necessary to appropriate one hundred million dollars to maintain the fund for reclaiming the arable public lands of the west rather than to allow a continuation of the present system.

The cream of the people's land is being skimmed each year; and with less than a hundred million acres which may be considered as reasonably possible of settlement, it can be but a very short time, at the present rate of segregation, before this has disappeared and the area which congress proposed to improve for the home-builders will have been included within the boundaries of great pastures producing not a thousandth part of their possible annual contributions to the wealth and prosperity of the country.

Outlook of the Timber Supply of the United States: Professor B. E. FERNOW, director, State College of Forestry, Cornell University.

This paper reviewed, upon the basis of the last census and of other statistics, the consumption of wood products in the United States, and the probabilities of meeting the same from the virgin supplies still on hand.

Contrary to expectations, the wood consumption of the leading industrial nations has, in spite of substitutions, constantly increased during the last forty years, and that greatly in excess of the increase in population, as a result of greater industrial activity and higher civilization; the increase in per capita consumption in Great

Britain being by five per cent. annually in the average; for Germany and France, ten per cent., and for the United States the apparent increase indicated by census statistics is above this last figure.

The total wood consumption for the United States is placed at round twenty-five billion cubic feet, of which over seven billion is log-size material, the important part needed for the industries.

After analyzing the relative value and importance of the different parts of this consumption, in which the conifers are shown to furnish three fourths of the log-size material, the question of supply is discussed.

It is shown that Canada, the only country from which such supplies can be imported, can not be relied upon for any length of time.

A probability calculation of the present stand of virgin timber in the United States, ready to supply the demand for lumber, although admittedly on a slender basis, brings out the improbability, if not impossibility, of meeting the increasing demand for another thirty years, under present methods of utilization. Even if the entire forest area of 500 million acres were supposed still fully stocked with the average stand per acre, as reported by the census in the holdings of lumbermen—an absurd proposition—the stock on hand would be exhausted within that period.

The possibilities of securing the requirements from the reproduction in the natural forest are discussed on the basis of European experiences, and with proper reference to the damaging forest fires. It is shown that even under good forestry practice, the present increasing demand could from the present area be supplied only for a limited time. Hence the efforts to secure such forest management and greater economy in the use of timber are not too early, but rather too late, and the dallying with the problem by the legislatures fatal.

Sociological Aspects of the Irrigation Problem: GUY E. MITCHELL, editor, *The National Home-Maker.*

The reclamation of arid America through government construction of irrigation works will furnish for years to come an effective outlet for the industrious surplus of our great cities. The irrigation sections of the west present almost ideal rural conditions. The tendency is, where water is used for farming, to subdivide land into small individual holdings, which gives to a community a prosperity and stability not found in larger farming districts, nor in cities. This is not a new idea. But while this is being done, the people of the entire United States will become so educated on irrigation matters and irrigation methods that there will be a gradual spreading eastward of the irrigation idea, which will eventually result in the subdivision of great numbers of large eastern and southern farms and plantations which are now farmed without thought of artificial water supply, into smaller irrigated farms. Never a season goes by even in the best watered districts of the rain belt that there is not some period of plant growth where the judicious application of water would very greatly increase the yield, and in some years double and treble it. It takes only a year of excessive drought among eastern farmers to get them talking about irrigation, but little comes of it, for the reason that they are entirely unfamiliar with irrigation methods and have no idea how to go about the practice of supplementing the natural water supply.

The irrigation then of the one hundred million acres of western plains and valleys, while it will create innumerable small rural homes of five, ten, twenty or thirty acres

each, will serve further to encourage subdivision of larger areas in the east and south and tend to make the small farm and home a general rule throughout the entire country.

Under wise administration, arid America has a glorious future. With her countless small farms and rural homes, communities where people live in the open air, till the soil with their hands and yet enjoy the privileges and advantages of the city, she will prove the sheet anchor of the republic in any time of national peril, while from her will radiate eastward the same idea of the division of the large into small farms and the utilization of the stream and the pond in making certain and increasing an oftentimes unreliable crop.

An Inquiry Into the Composition of Creamery Butter: Major HENRY E. ALVORD, chief of Dairy Division, Department of Agriculture.

The value of butter depends upon the fat it contains, and although there are necessarily other constituents, and they have value, they should not be in excess. This is especially true of the water content. Purchasers do not wish to buy water by the pound at butter prices. The product of creameries, or the factory system, is the leading grade of butter in the markets. Creamery butter has been alleged ordinarily to carry too much water. There has been no reliable basis for such assertions, and it has seemed desirable to ascertain the facts.

During the year 1902, the U. S. Department of Agriculture (Dairy Division) has had opportunity for examining 730 different packages of butter, representing the product of 400 different creameries, located in eighteen states. The butter was made in May, June, August and September. Moisture determinations were made on 802 samples. The range of water content was found to be from 7.20 per cent. to 17.62 per cent., and the general average was 11.78 per cent. There were but three results below 8 per cent. and only eight above 16 per cent. Seven eighths of the 802 samples were between 10 and 14 per cent., and more than half between 11 and 13 per cent.

Making all reasonable allowance for error, it seems safe to state that American creamery butter, during the months named, has an average water content not exceeding twelve (12) per cent.

Education for Farmers: Professor WILLET M. HAYS, Minnesota Agricultural Experiment Station.

The states are gaining charge more and more of education. By unifying the primary and graded schools, the city high schools, and the universities and colleges into an articulated system, education has been greatly promoted. But the current in this system is away from the farm, and a parallel system is suggested in which the student must go against the current to leave the farm. The suggested system includes the consolidated rural school, with free transportation of pupils, serving an area three to five miles square; the agricultural high school, serving ten or mor counties; and the agricultural college, serving the entire state. The consolidated rural school supplies superior primary education; could include some studies of rural industries; and a small demonstration farm and garden could be added to the equipment. By extending the course in the consolidated rural school to include the freshman and sophomore high-school studies, the pupils are longer under the parental roof; and the expense of non-resident study in the agricultural high school is reduced to the junior and senior years, which study may be made largely technical. The civic and economic,

as well as the educational, value of such a system is urged.

School Gardens: Miss Louise Klein Miller, director of the Lowthrope School of Horticulture and Landscape Gardening for Women.

Educators are becoming alive to the importance of school gardens as a potent factor in education, and the next five years will see rapid progress in this direction.

The schools of Europe are far in advance of us in this phase of education, and the agricultural and horticultural progress is largely due to the efficiency of the school gardens. In Austria-Hungary alone there are 18,000 school gardens. In France, the teachers are required by law to be able to instruct their pupils in the elements of agriculture and horticulture, and normal schools have been established for the purpose of giving teachers such training. No plans for school buildings to which the state contributes are approved unless accompanied by plans for a school garden. The study of horticulture is compulsory in Belgium. In Germany and England, school gardens are encouraged, but not regulated by law. Some excellent work has been done in this country, but in many instances the educative features have been made subservient to the raising of vegetables.

The theory and practice of gardening satisfies certain dominant interests in a child's physical, mental and moral evolution; affords an opportunity to expend normally and naturally often misdirected energy; develops an appreciation of the proper values of things; quickens a knowledge of the close interrelations in nature; gives fundamental principles of great economic significance; suggests some of the great problems in the struggle for existence; teaches the dignity of labor and personal responsibility.

The day is not far distant when a supervisor of school gardens will be as important an officer in a school system as a supervisor of music or drawing. Children are not satisfied with evasive answers. They are alert, inquisitive and intelligent, and a teacher who wishes to gain their confidence and keep their respect must be able to respond to most of the demands made upon her, and have her knowledge at her tongue's end and finger tips. This is an open field for women, and in this capacity an earnest, capable and enthusiastic teacher can render valuable service to the public good.

A difficult problem for the economist and sociologist to solve is the herding together of a large population in a crowded city. Strenuous efforts are being made to turn the tide countryward, and induce persons to seek homes where life will be freer and more wholesome. If the elements of agriculture and horticulture were taught in country, town and, so far as possible, in city schools, in an intelligent, scientific and attractive manner, life in the country would be the joy that the opportunity affords.

Frank H. Hitchcock,
Secretary.

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*THE UPPER TEMPERATURE LIMITS OF LIFE.**

The upper temperature limits of continued and active life are possible of observation most satisfactorily in the case of the organisms inhabiting hot springs. Such springs are widely distributed in both hemispheres and vary in temperature from tepid to boiling. In all these springs, except in the very hottest waters and in those in which there is something in the chemical composition which prevents, organisms have been found. Various indi-

* Abstract of an address before the California Chapter of the Sigma Xi, Berkeley, April 28, 1903.

vidual references have been made to the organisms living at higher temperatures in such springs, such as are tabulated by Davenport in his ' Experimental Morphology ' (Vol. I., pp. 249–267), under the heading of ' Acclimatization to Heat.' As may be seen from the references there given, and more particularly from Davenport's notes on the different records, as well as from an examination of the records themselves, there is a very decided lack of good strong evidence as to exact temperatures and the kinds of organisms occurring at the temperatures given or hinted at. The records are largely of isolated observations, generally made incidentally and without, in any case, being a portion of any extensive work to determine temperature limits. As far as the literature goes, there seems to have been nothing systematic attempted along these lines.

It has been my own good fortune to study with considerable care and thoroughness the thermal organisms of several distinct regions. The first observations were made at the Arrowhead and Waterman Hot Springs near San Bernardino, California, being introduced to them through the kindness of Mr. S. B. Parish of that city. The visits made to these springs were three in number, in as many different years. The organisms of the hot waters of the so-called geysers in Sonoma County, California, as well as those of several minor hot springs near Calistoga, in Napa County of the same state, were collected and the temperatures carefully noted in June, 1900. In August, 1898, ten days were spent in the Yellowstone National Park, under the auspices of the United States Geological Survey, examining the life in the hot waters of the Mammoth Hot Springs, the Norris, Lower, Middle and Upper Geyser Basins, the Lakeshore Hot Springs, and of other lesser collections of springs. In all, several hundreds of gatherings have been made, the specimens carefully preserved and studied, and the results are awaiting publication. Among other things, especial care was taken to determine accurately and record the exact temperature at which each specimen was growing, so that the data of this character might be complete for the whole series. Not only were the highest temperatures at which living organisms were found, taken, but the temperatures of all organisms inhabiting strictly thermal waters. The results of all my own observations agree perfectly and present a series of facts somewhat at variance, at least in certain essential details, with the results of other observations as tabulated by Davenport. Many, or even the large majority, of the discrepancies disappear, or may be plausibly explained, however, when one considers how erroneous certain temperature observations may be, unless taken with certain precautions.

In my own work it was found very soon that, unless very considerable care was exercised, the temperatures were not those at which the organism was living. It was found, for instance, that it was extremely misleading to take the temperature of a spring and then credit the temperature of any organism existing at any distance from that point as being the same. The central portion of a spring with shallow margins may be of a considerably higher temperature than the margins. In the case of streams, the temperature of two points only a few centimeters distant from one another may differ 10°–15° C. on account of currents imperceptible except to the thermometer. Especially is this likely to be the case in springs or overflows into which colder currents come from side streams, whether these be of thermal or cold waters. The temperatures of masses

of organisms partly or wholly emergent from the waters are difficult to ascertain with certainty, but in the majority of such cases which have come under my own observation, the only living portions of such masses were comparatively cool. The temperatures which seem sufficiently certain to place implicit confidence in were taken with the following precautions: (1) temperatures only of submerged tufts were taken; (2) the bulb of the thermometer was placed within, or just at, the sample which was removed and preserved for microscopical study; and (3) in a very considerable number of cases, particularly of the highest temperatures noted, samples and temperatures were taken at the same spot on different days, or times of the year.

The results of all these observations, taken with the precautions indicated above, give certain general results for the strictly thermal waters—*i. e.*, for waters over 43°–45° C. The temperature results may be indicated under a number of different heads:

1. No animals were found in strictly thermal waters, although careful search was always made for them.

2. No living diatoms were found in strictly thermal waters. At times, a few empty valves were found, but these may easily have been blown in, since the localities were in the neighborhood of extensive areas of diatomaceous earth.

3. All the organisms found in my own collecting in strictly thermal waters belong to the groups of plants designated as Schizophyta, being either Schizophyceæ (Cyanophyceæ) or Schizomycetes (Bacteria). These two groups possess a simple morphology and peculiar cell-structure.

4. The chlorophyllose Schizophyceæ (or Cyanophyceæ) commonly continue up to 65°–68° C., and in some cases, but scantily, up to 75°–77° C.

5. The chlorophylless Schizomycetes (or bacterial forms) endure the highest temperatures observed for living organisms, being abundant at 70°–71° C. and being found in some considerable quantity at 82° C. and at 89° C.

6. The temperature of 89° C. is the highest at which I have been able to find any organisms living. This temperature was taken at several different times and on two separate days. The organism belongs to the filamentous Schizomycetes. Search was made most carefully at the 'geysers' of Sonoma County, California, for green organisms at 93° C., as recorded by Brewer, but no life was observed at any temperature above 68° C.

7. Living organisms were found at higher temperatures in siliceous waters than in calcareous waters.

8. The limits of life in the siliceous waters, as determined by my own observations, are between 75° C. and 77° C. for chlorophyllose, and 89° C. for chlorophylless Schizophyta.

9. The limits of life in the calcareous waters, as determined by my own observations, are between 60° C. and 63° C. for chlorophyllose Schizophyta and between 70° C. and 71° C. for chlorophylless Schizophyta.

10. No organisms were found in springs reputed to have a decided acid reaction. This needs more study, but where a strong acid (sulphuric) character is given for a spring, the waters are free even from Schizophyta.

A careful study of the species of thermal Schizophyta shows several details of interest. They are either filamentous or unicellular, but in each case the filaments or cells are enclosed within a jelly, usually abundant. Within the strictly thermal

limits, only one member of the higher and heterocysted Cyanophyceæ has been noted, viz., *Hapalosiphon laminosus*. This species does not reach the upper temperature limits, even for the chlorophyllose forms. The majority of the chlorophyllose forms are either species of *Phormidium* or unicellular forms peculiar, as far as known at present, to the thermal waters. The chlorophylless forms, as far as detected, are filamentous, very slender, and belong to the group known as the sulphur bacteria. All of these forms are very closely related, even the so-called sulphur bacteria being little else than colorless species of *Phormidium*. A matter to be emphasized is this—that all of the strictly thermal organisms are low forms, not even representing the higher differentiation in the group to which they belong.

The question is always raised, in the case of the thermal organisms, as to the nature of the protoplasmic contents of the cells. What is it that enables the protoplasm of the thermal organisms to withstand a temperature which coagulates, and consequently kills, the protoplasm of the majority of organisms. We find that when a proteid, like egg albumen, is free from water, it does not coagulate at the very highest temperatures which leave it unburned, and that the less the content of water, the higher the temperature of coagulation. The cell structure in the Schizophyta is peculiar, being quite different from that of other groups of organisms. While the details are not satisfactorily settled, there seems to be a certainty that there is less differentiation than in other groups. Whether we believe that the protoplast is all nucleus or whether we believe that it is all cytoplasm, it remains clear that it is different from the protoplast of other groups of organisms and affords us room for surmise. There is nothing, so far as my own study of the Cyanophyceæ cell is concerned, to indicate that the protoplasm contains so little water as to render it incoagulable by the higher temperatures which it endures. It seems rather that there may be some important difference in the essential proteids of the mixture, or in the nature of the constitution of the substance, if it be regarded as simple, which renders it less coagulable, a difference similar to that existing between a substance of the group of the vitellins and one of the group of the globulins.

WILLIAM ALBERT SETCHELL.

SCIENTIFIC BOOKS.

THE SUGAR INDUSTRY.

Anleitung zur Untersuchung der für die Zuckerindustrie in Betracht kommenden Rohmaterialien, Produkte, Nebenprodukte und Hilfssubstanzen. Sechste umgearbeitete und vermehrte Auflage. Von R. FRÜHLING. Braunschweig, Friedrich Vieweg und Sohn. 1903. Pp. xxi + 505. Marks 12.00.

The rapid advances made in sugar chemistry within the past few years have necessitated a thorough revision of and the introduction of a considerable amount of new matter in this, the sixth, edition of Frühling's 'Anleitung.'

Examination of the book shows that the author has spared no pains to do justice to his self-imposed task.

Adoption of the regulations of the International Commission for Uniform Methods of Sugar Analysis, Paris, July 24, 1900, has of course resulted in the introduction of fundamental changes. The metric cubic centimeter has replaced the Mohr cubic centimeter; the normal sugar weight is now 26,000 grams instead of 26,048 grams; 20° Centigrade has been accepted as the standard temperature for the preparation and the polarization of sugar solutions. Space is given to the extensive table showing the relation between the specific gravity of sucrose solutions at 20° C. and the sucrose percentage of such

solutions, which table has been prepared by the Imperial *Normaleichungskommission*. Attention has also been paid to the determination of the alkalinity of first products, to the determination of sucrose in the presence of invert-sugar, raffinose, etc.

About one half of the book is given over to sugar-analysis, or rather, to be more precise, to the analysis of sugar and sugar-containing compounds. The rest of the work treats of the analysis of bone-black, water, limestone, gas-analysis, fuels, fertilizers and so on, and in most of these sections considerable changes and improvements are also to be noted.

A recalculation of all numerical data and problems was made imperative by adoption of 16 as the atomic weight of oxygen.

Paper and print are excellent, and the numerous illustrations a feature of value.

F. G. Wiechmann.

SOCIETIES AND ACADEMIES.

THE AMERICAN PHYSICAL SOCIETY.

The spring meeting of the Physical Society was held at Columbia University, New York City, on Saturday, April 25. An unusually large program of fifteen papers was presented, and the attendance was above the average.

The first article was by H. T. Barnes and E. G. Coker, and dealt with the 'Flow of Water through Pipes in Stream Line Motion with Special Reference to the Critical Velocity.' By taking every precaution to have absolutely quiet water in the tank which supplied the pipe studied, it was found possible to increase the critical velocity much beyond the limit found by previous observers. The presence of little disturbances in the water entering the pipe seems to have a strong tendency to break up stream line flow into an irregular eddy flow. For small pipes the authors found that two critical velocities might be observed. As the velocity was increased from a low value a speed was reached at which stream line flow ceased and eddies formed. If the velocity was increased still more, another critical stage was reached, beyond which the flow again occurred in stream lines.

Messrs. H. T. Barnes and D. McIntosh described a form of platinum thermometer especially designed for work with the continuous flow calorimeter and avoiding many of the difficulties met with in previous forms.

In a paper on 'Architectural Acoustics' G. W. Stewart described a series of experiments made in the auditorium of Sibley College at Cornell University. The reverberation in this hall when first completed was so bad that a speaker could hardly be understood at all. It seemed to offer a good opportunity to test the methods and conclusions developed by Sabine in his work on architectural acoustics. Mr. Stewart found a complete agreement between the results obtained by experiment and those computed upon the basis of Sabine's theory.

A paper on the 'Spectral Energy Curve of a Black Body at Room Temperatures' was also presented by Mr. Stewart. In order to obtain radiation from a body at room temperature the vane of a radiometer was used as a radiating surface, while in front of the slit of the mirror spectrometer used was placed a body at the temperature of liquid air. Under these circumstances, since the radiation from so cold a body is practically nil, the cooling of the radiometer would be due to its own radiation, and the deflections observed in the different parts of the spectrum would measure the radiation for particular wave-lengths. The curve showing the distribution of energy in the spectrum had the same general form as that observed at higher temperatures. The maximum occurred at 9.2 μ, the position of the maximum differing from that computed by Wien's formula by about 0.6 μ. The energy curve was compared with that computed from Planck's theory, and variations of ten per cent. were noticed, although the curves were alike in general form. In view of the fact that the maximum deflection obtained was not quite 4 mm., such differences were not surprising.

The results of determinations of the specific heats of certain organic solids were presented by W. F. Magie. Fourteen substances were examined, the Pfaundler calorimeter being employed. The results were compared with

the theory advanced by Staigmüller, showing a reasonably close agreement. The heats of solution in water were also determined.

An article by E. H. Hall 'On C_v for Liquids and the a of Van der Waals' called attention to a disagreement between observation and certain conclusions based upon Van der Waal's equation.

Mr. A. W. Smith described the methods used in a careful redetermination of the Heat of Fusion of Ice. An electrical method was employed, every precaution being taken to obtain results in absolute units. A calculation based upon a preliminary determination gives 334.25 joules for the heat of fusion of ice prepared from pure distilled water.

Mr. J. S. Shearer reported the results of a determination of the 'Heat of Vaporization of Nitrogen,' the method being that previously used by him in determining the heat of vaporization of oxygen. The value found was 49.8 calories per gram. Since the latent heat of oxygen is much greater than this, it becomes a matter of interest to determine the heat of vaporization of air as a function of its composition. This determination had been carried out by J. S. Shearer and F. R. Strayer, who reported that the heat required to vaporize air is the same as would be required to vaporize the constituents separately.

It has long been known that ordinary slow evaporation is not accompanied by electrification. When a mass of water is suddenly shattered, however, as in jets, marked electrical effects are produced, but these persist only for a short time. The question then arises whether electrical effects may not be present in ordinary cases of evaporation, vanishing so quickly as to be undetected. Experiments to test this point, by investigating cases of *sudden* evaporation or condensation, were described in a paper by Carl Barus. No electrical effects could be detected.

Mr. Barus also presented a paper showing that condensation nuclei are produced by the mixture of ordinary coal gas and air. The nuclei are not ionized. They are probably due to chemical action resulting from the presence of sulphur in the gas.

'A Preliminary Note on the Selective Absorption of Organic Compounds in the Infrared' was presented by W. W. Coblentz. Thirty-eight substances had thus far been studied, observations extending to a wavelength of 15 μ. The results were of especial interest in the case of related compounds, for example, the substitution derivatives of benzene. Certain radicals, such as CH and CH_2, were found to produce well-defined bands in the absorption spectrum of any substance in which they appeared. In some instances series of bands were found in which the wavelengths were simple multiples of one another (*e. g.*, CH_2 bands were found at 3.5 μ, 7.0 μ, 10.5 μ). As its title indicated, the report is preliminary. Mr. Coblentz is to continue the work with the aid of a grant from the Carnegie Institution.

The remaining papers on the program were: 'An Attempt to Construct an Electrostatic Transformer,' J. E. Ives; 'Note on the Bending of Rock Salt,' W. W. Coblentz; 'A Modification of the Quadrant Electrometer without Liquid Contacts,' C. Barus.

At the meeting of the council fifty-five new members were elected. This number of elections exceeds that of any previous meeting, and doubtless indicates the appreciation by the physicists of the country of the recent arrangement made by the society with *Science Abstracts* and the *Physical Review*. The proceedings of the society are now published in the *Physical Review*, which is sent to all members. The Physical Society also cooperates with the Institution of Electrical Engineers and the Physical Society of London in the support of *Science Abstracts*. Membership in the Physical Society thus carries with it a subscription to both the *Review* and the pure science part of *Science Abstracts*, at a total cost of only a little more than half the regular price of these two journals.

Under these circumstances it is evident that the question of discrimination in the election of new members becomes an important one. The question was discussed at some length, and the sentiment in favor of a distinctly conservative policy was unmistakable. The Physical Society is not to be an honorary society, such, for example, as the National

Academy. But effort is to be made to keep it a *working* society, and not merely an association of men having some general interest in physics. It is expected that new members will in general be chosen only from the active workers in physics—from such as have either already contributed to the advancement of the science or have shown especial promise of becoming investigators later. That exceptions to this policy may occasionally be made is of course probable, but it was felt that such exceptions should be rare.

Ernest Merritt,
Secretary.

North Carolina Section of the American Chemical Society.

The spring meeting of the section was held in the chemical lecture room of the University of North Carolina, Chapel Hill, on May 8, 1903, at 8:15 P.M., with Presiding Officer Charles E. Brewer in the chair. After the transaction of some miscellaneous business, the following papers were presented and discussed:

A Simple Hydrogen Sulphide Apparatus: Chas. E. Brewer.

This apparatus is an adaptation of well-known principles. Its peculiar interest lies in the fact that it may be used on the laboratory desk. The parts are a bottle (250 c.c.) with a two-hole rubber stopper to fit, a separatory funnel (100 c.c.) passing through one of these holes to the bottom of the bottle to serve as a reservoir for the acid, an Erlenmeyer flask (any size desired) with a one-hole rubber stopper to fit, glass and rubber tubing to connect bottle and flask, with as many wash bottles between as may be desired. The bottom of the bottle is covered with shot to a depth of one inch, so as to keep the acid off the sulphide while the gas is not needed. The delivery tube passes through the stopper to the bottom of the flask which contains the solution to be treated. The stopper is inserted loosely until the air in the flask is driven out, then tightly to prevent escape of gas, which comes over as fast as it can be absorbed. It hastens saturation to shake the flask from time to time.

The Assimilation of Nitrogen by Bacteria: G. S. Fraps.

This refers to bacteria which assimilated nitrogen without symbiosis. The effect of the nature of the medium, the time, the temperature and the soil used for inoculation of the medium were studied. Addition of magnesium sulphate to a medium containing glucose, potassium phosphate, ferric chloride, sodium chloride and calcium carbonate increased the amount of nitrogen assimilated.

Nitrification of Different Fertilizers: W. A. Withers and G. S. Fraps.

The nitrification of different fertilizing materials was compared in four soils. There was some variation. Placing the amount of nitrogen nitrified in cotton seed meal at 100, the amount of ammonium sulphate nitrified varied from 13 to 127; dried blood, 70 to 120; fish, 85 to 190; bones, 22 to 43, while less nitrification took place when barnyard manure was present than when it was absent. Very much larger amounts of manure were used than are used in farm practice, and with smaller amounts different results would perhaps be obtained.

Nitrifying Powers of Typical North Carolina Soils: W. A. Withers and G. S. Fraps.

The nitrifying powers of fifteen typical soils, collected and classified by the Bureau of Soils, and the North Carolina Department of Agriculture, under the same conditions as regards temperature, water content, number and kind of germs, and time, varied from 11 to 106, compared with a standard soil placed at 100. The soils with the lowest nitrifying powers are sands, with low water capacity, low humus, low absorptive power for ammonia and low acidity, though a soil low in any or all of these does not necessarily have a low nitrifying power. Acidity of the soil did not prevent nitrification.

Report—Progress of the Dyeing Industry: G. S. Fraps.

A discussion of the most important lines of advancement, particularly as regards the introduction of sulphur colors, the production of mercerized cotton and artificial silk, and the manufacture of synthetical indigo.

Derivatives of Trichlorethylidene di-p-nitrophenamine: A. S. WHEELER and M. R. GLENN.

This body, on treatment with alcoholic potash, gives a monohydroxy-derivative by replacement of one chlorine; with sodium methylate, a monomethoxy-compound; with bromine, a dibrom-derivative with bromine in the rings; with zinc dust, a compound containing no chlorine.

Determination of Glycerine: A. S. WHEELER and W. R. WELLER.

Chaumeil's method in which iodic acid is used was found to give high results.

Mercurous Sulphide: CHAS. BASKERVILLE.

This body was formed by the prolonged action—through five years—of concentrated sulphuric acid (99.65 per cent.) upon pure mercury.

Recent Work on the Rare Earths in the Chemical Laboratory of the University of North Carolina: CHAS. BASKERVILLE.

An abridgment of his recent lecture before the New York Section with two additions; first, a new method for purifying neodidymium (with Stevenson), and second, an elaboration of that portion touching radioactive bodies and fluorescence. The paper was fully illustrated with specimens and a few experiments.

Note on the Thermodynamical Calculation of the Latent Heat: J. E. MILLS.

Attention was called to the fact that when the constants for Biot's formula were known, differentiation of this equation would give $\partial p/\partial t$. Substitution in the ordinary thermodynamical equation for calculating the latent heat could then be directly effected, with a great saving in the calculations involved.

Molecular Attraction: J. E. MILLS.

If at any temperature the internal latent heat of vaporization be divided by the difference of the cube roots of the densities of liquid and vapor, the result should equal a constant, according to a published theory of molecular attraction (*Jour. Phys. Chem.*, April, 1902). It was shown that the latent heats for ether, benzene and carbon tetrachloride gave a good agreement with the theory to within a few degrees of the critical temperature.

Some New or more or less Novel Forms of Laboratory Apparatus: J. M. PICKEL.

(*a*) An unusual form of siphon.

(*b*) A modified form of a previously described filter-washer.

(*c*) An automatic measurer and dispenser of the acid used in Kjeldahl nitrogen determinations.

(*d*) Same for the alkalies.

(*e*) A stand for Kjeldahl digestion flasks.

(*f*) A file for samples contained in bottles.

(*g*) A desiccator for equalizing inside and outside air pressure.

(*h*) An appliance for utilizing the incandescent electric light as source of heat in fat extractions with ether.

(*i*) An asbestos furnace for gold assays.

(*j*) An economical but efficient blast-lamp.

(*k*) Spiral support for round-bottom flasks.

An Efficient Asbestos or Graphite Muffle: J. M. PICKEL and C. B. WILLIAMS.

This muffle has been used principally in the determination of potash in fertilizers. It is very efficient and has given satisfaction in other respects. A description of it will soon appear.

After the completion of the program Dr. Charles Baskerville tendered the members of the section and their friends an informal 'smoker' at his residence.

C. B. WILLIAMS,
Secretary.

THE GEOLOGICAL SOCIETY OF WASHINGTON.

AT the 144th meeting of the society, held in assembly hall of the Cosmos Club, Wednesday evening, May 6, 1903, the following program was presented:

Professor Lester F. Ward: 'Correlation of the Potomac Formation in Maryland and Virginia.'

In this paper Professor Ward outlined the present status of the Potomac formation, as determined from numerous rich collections made in recent years, chiefly by the Maryland workers, and studied and reported upon by Professor Fontaine. The position and extent of the Potomac belt within Maryland and

Virginia and the principal localities represented in the collections were shown by maps. The entire review, with Professor Fontaine's reports, and numerous plates, will be published shortly as a professional paper of the U. S. Geological Survey.

Mr. M. R. Campbell: 'Pocono Rocks in the Allegheny Valley.'

Recently Mr. David White and Mr. Campbell obtained fossils from the Allegheny Valley which show (1) that Pocono rocks having a thickness of at least 130 feet are present in Armstrong County, Pa.; (2) that the Pottsville is 140 feet in thickness and consists of the Homewood and Connoquenessing sandstones separated by the Mercer coal group; and (3) that the well-marked Pocono and Pottsville are separated by a mass of sandstone and sandy shale having a thickness of about 80 feet and apparently barren of fossils. Although these beds can not be classified definitely, there are some reasons for referring them to the Pocono. If this reference is correct the Mauch Chunk shales and Sharon conglomerate are absent and the Connoquenessing sandstones rest directly on rocks of Pocono age.

Mr. David White: 'Age of the Mercer Group.'

Under this title Mr. White communicated certain conclusions and correlations resulting from the study of the fossil plants of the group. He described the pteridophytes of the Mercer flora as a mixture of distinctly upper Pottsville elements with the earliest, and often slightly archaic, representatives of the common species of the Allegheny. Considerable change is noted between the plants in shales resting on the top of the Connoquenessing at certain localities and those immediately underlying the Homewood sandstone at others, the duration of Mercer time, as indicated by the floras, being greatly disproportioned to the relatively small thickness of the group in Pennsylvania and Ohio. Such a comparative duration is, however, in part suggested by the composition of the group, which embraces coals, limestones, iron ores and fire-clays in the northern region. The associated fossil plants indicate that the refractory or 'flint' clays worked at many points in Somerset, Cambria, Centre, Clearfield and Jefferson counties, as well as the famous Mount Savage clays in western Maryland, belong to the Mercer group, which is shown to be the stage of a belt of refractory fire-clays extending irregularly from the Potomac basin, in northern West Virgina, northward around the border of the main bituminous field through McKean County and as far as St. Charles on Red Bank Creek in northern Armstrong County.

The Mercer group is correlated by the author of the paper with the lower stage of the Westphalian (Sudetic) or the Lower Coal Measures of Europe. The more complete knowledge of its flora throws much light on the age of the Kanawha formation in the southern Virginia regions, additional collections from which have recently been examined. In a discussion of the age of the Kanawha in 1899, the speaker had shown that the greater portion, embracing not less than 600 feet, of the formation, antedated the Allegheny formation, although the northern equivalents of the formation were not definitely known. It now appears that its partial equivalence with the Mercer, then conservatively proposed, is conclusively shown by the plants, and that a great portion of the Kanawha formation is to be regarded as the southern extension of the Mercer group. The further study of the floras indicates not merely that the middle of the formation may be of Mercer age, but that beds up to within 125 feet of the 'Black Flint' are clearly referable to the latter group, while the basal Allegheny time boundary is probably very much nearer the level of the Black Flint.

During the evening of May 13 a special meeting was held in continuation of the 140th regular meeting, which was devoted to a discussion of the 'Quantitative Classification of Igneous Rocks.' No formal papers were presented, but the practical workings of the new classification were commented upon by several petrographers who had tested it, and observations, critical and commendatory, from foreign workers were read and discussed.

W. C. Mendenhall,
Secretary.

PHILOSOPHICAL SOCIETY OF WASHINGTON.

THE 569th regular meeting was held May 9, 1903. The first paper was by Dr. H. Carrington Bolton, on 'The Genesis of Hygrometers and Anemometers.'

The earliest recorded instruments for measuring the moisture in the atmosphere were those of Nicolas de Cusa, about 1450; they were bits of wool and of sponge fastened to one arm of a balance. Leonardo da Vinci invented a more perfect hygrometer, consisting of a metallic ring with a graduated scale which bore at its center a movable rod, to the ends of which were fastened small spheres of metal, one covered with wax and one with cotton wool. Leonardo thought the wax repelled moisture and the cotton absorbed it.

Sanctorius in his 'Medicina statica' (Venice, 1614) mentions three hygroscopic substances, the 'dregs of alum,' thin boards and strings of a lute.

The Italian physicists of the Accademia de Cimento employed a conical vessel filled with ice for condensing the moisture of the air. The ingenious Robert Hooke describes in his 'Micrographia' (1664) a hygrometer, the essential feature being the awn of wild oats.

The weather-mannikin, still common in Germany, was invented in 1685 by Wm. Molineux. In the eighteenth century a very great variety of hygroscopic bodies were employed, from wood through guts of animals to marine algæ and deliquescent salts, but De Saussure's hair hygrometer was found to excel.

John Dalton in 1801 proposed noting the dew point, and Leslie's psychrometer was invented about the same date. Daniell's condensing hygrometer dates from 1820.

The earliest anemometers were those invented about 1578 by Egnatio Danté, a Dominican monk. It is similar to that of Wild's tablet-anemometer reinvented in 1860. The speaker described briefly a large number of instruments for measuring the velocity of the wind down to Robinson's cup anemometer now in use, first brought out in 1850.

Dr. Bolton called attention to the fact that every one of the fundamental instruments now used in meteorological observations is of Italian parentage:

1450.....Hygrometer, Nicolas de Cusa.
1578.....Anemometer, Egnatio Danté.
1595.....Thermometer, Galileo.
1639.....Raingauge, Cartelli.
1643.....Barometer, Torvicelli.

Mr. E. E. Hayden, of the Naval Observatory, then described, with aid of lantern observations, the 'Naval Chronometer and Time Service.' The Navy possesses about 800 chronometers, and for the rating of these elaborate provision is made at Washington; further facilities are provided at Mare Island Navy Yard, Cal., and at Cavite. The tests used were described, diagrams were exhibited to show the actual behavior of instruments under service conditions, and the details of the daily telegraphic time service were explained.

The last paper of the evening, by Mr. J. F. Hayford, dealt with the unusual features of the plans of a primary triangulation party of the Coast and Geodetic Survey on the 98th meridian triangulation in 1902. The triangulation was done at considerably more than double the usual rate for such work in the past, and at half the usual cost per station occupied under similar conditions. The work of a single season furnishes an arc of the meridian 6° long, twice as long as the famous Peruvian arc. The accuracy of the work is fully up to the best standards of the past. The observations were made upon heliotropes in the day hours and upon acetylene lights at night. The light keepers were given their orders by heliograph signals. Many of the observations were taken under apparently bad conditions upon very faint images, or images which were very large and fluctuating wildly. The observing towers, 42 feet high upon an average at each station, were erected by a separate building party of seven men, at an average rate of ten per month, the towers being scattered throughout the whole extent of the arc 446 miles long. No screens were found to be necessary to shelter the inner tower from the sun and wind, although such screens have been regularly used in the past.

The 570th meeting was held May 23, 1903. The evening was devoted to memorial addresses on deceased members as follows: By Dr. A. F. A. King, on Dr. S. C. Busey, lecturer, sanitarian and author; by Mr. B. R. Green, on Mr. Edward Clark, for many years architect of the Capitol; by Professor F. H. Bigelow, on Professor William Harkness, late of the Naval Observatory; by Mr. H. L. Marindin, on Professor Henry Mitchell, hydraulic engineer, latterly of the Massachusetts Institute of Technology; by Dr. Swan M. Burnett, on Mr. Charles Nordoff, journalist and author; by Mr. G. W. Littlehales, on Admiral W. T. Sampson, U.S.N.

Notices of Major J. W. Powell and Mr. J. W. Osborne that had been expected were unavoidably postponed. Charles K. Wead,
Secretary.

ANTHROPOLOGICAL SOCIETY OF WASHINGTON.

The 346th regular meeting was held on April 28.

Professor W. H. Holmes gave an account of his explorations in a hematite mine in Franklin County, Missouri, where there are ancient workings consisting of pits and drifts honeycombing the whole mass of ore. Numerous stone hammers, flint and chips were found about the pits, and it is evident that this locality was a favorite one among the Indians for procuring paint which occurs in pockets in the iron ore.

A communication from Mrs. Catherine Foote Coe, giving her impressions of travel in Japan, was heard with great interest, and a vote of thanks was extended to her.

Dr. W J McGee announced that the International Archeological Commission for the study and preservation of antiquities, which originated at the Pan-American conference held in Mexico in 1901, has made progress toward organization, and that on the third Monday in December next the representatives of the American republics will meet with adequate powers to complete the organization.

Mr. Ainsworth R. Spofford read a paper entitled 'The Folk-Lore of Popular Sayings.' Mr. Spofford, in calling attention to the great collections of sayings and proverbs in different languages, spoke of the wealth of such sayings in English and Irish. These, he said, possess a distinct ethical value in that they are almost invariably optimistic. The best sayings are of Latin, Greek or Oriental origin from the ages past. Sayings relating to the inanimate world, the animate world, professions in life and color were given, also rhymed sayings, sayings of noted men, maxims of unknown origin, weather proverbs and sayings referring to the days of the week. In the discussion of the paper Professor McGee remarked that proverbs prevail in lower culture and are wonderfully paralleled among different tribes, and said that we may almost predicate the stage of development of a people by their use of proverbs. In answer to a question Mr. Spofford said that no one can trace the origin of proverbs. The secretary pointed out the debt of language and literature to these pithy sayings, which are in reality word sentences. Mr. Pierce said that in many cases proverbs show their locality of origin, and Mrs. Tulloch gave examples. The president, Miss Fletcher, said that among Indians ethical proverbs are used in teaching, as, 'Stolen food does not satisfy hunger,' an expression of the Omaha.

'Some Exploded Theories concerning Southwestern Archeology' was the title of a paper by Mr. U. Francis Duff. These myths are the exaggerated estimates of early population, a distinct race of cliff dwellers, dwarf tribes, the destruction of tribes by cataclysms or pestilence, the destruction of villages by lava, the Gran Quivera myth, and the finding of gold in the southwestern ruins. Professor McGee, in discussing the paper, said that in the valley region the extensive irrigation works show that the population was very large, as it would not be necessary to take water far out in the valley to higher levels if the land were not occupied in the near valley. In answer to a question by Mr. McGuire as to the Spanish origin of the ditches, Professor McGee said that the irrigation works show no traces of European culture. Other points were taken up and discussed by members.

Walter Hough,
Secretary.

SCIENTIFIC JOURNALS AND ARTICLES.

THE May number of the *Botanical Gazette* contains a paper by Dr. A. A. Lawson, of Leland Stanford University, on 'The Relationship of the Nuclear Membrane to the Protoplast,' in which he holds that the typical nucleus of the higher plants is a water cavity, structurally similar to the vacuole, the chromatin being the only permanent constituent, while the nuclear membrane originates by the cytoplasm coming in contact with the karyolymph, just as the tonoplast is formed by the cytoplasm coming in contact with the cell sap. Dr. B. M. Davis concludes his paper on 'Oogenesis in *Saprolegnia*,' with an extended theoretical discussion of the homologies, origin and evolution of the coenogamete, the occurrence of coenogametes among the Ascomycetes, the phylogeny of Phycomycetes and Ascomycetes, and the nucleus of Phycomycetes in ontogeny. An ecological paper by Mr. J. Y. Bergen, now residing in Naples, discusses the thickets of under shrubs known locally as *macchie* of the Neapolitan coast regions. Dr. F. L. Stevens, of the Agricultural College of North Carolina, describes the occurrence of 'Nutations in *Bidens* and Other Genera,' quite similar to the well known nutations of the sunflower. Fernow's 'Economics of Forestry,' Boulger's 'Woods'; 'Postelsia' and other current works are reviewed.

THE July number of the *American Journal of Mathematics* contains the following articles:

'Isothermal-Conjugate Systems of Lines on Surfaces.' By L. P. Eisenhart.

'Some Differential Equations connected with Hypersurfaces.' By G. O. James.

'On the Forms of Sextic Scrolls of Genus Greater than One.' By Virgil Snyder.

'Geometry on the Cuspidal Cubic Cone.' By Frederick C. Ferry.

DISCUSSION AND CORRESPONDENCE.

THE PROPOSED BIOLOGICAL STATION AT THE TORTUGAS.

TO THE EDITOR OF SCIENCE: In the marine biological stations (which carry on, it must be remembered, only a portion of all biological work) two tendencies, opposite at first sight, but really directed toward the same high aims, are discernible. The one tendency is to investigate the phenomena of structure, development and function in the individual; the other is to consider individuals in masses as species, as form-units bearing the imprint of environment, and adapted thereto, and as constituents of faunas. For students of the first sort of marine zoology what is required is one large central laboratory, with an extensive library and the requisite cytological and physiological apparatus, where students of anatomy, embryology and physiology may work together and give mutual aid and stimulus. The needs of the workers on the other side of marine zoology call for several laboratories, widely separated, in diverse environments. These will assist the first sort of laboratory by furnishing particular kinds of material found only in the locality. But their chief work will be to study the fauna, determining the laws of geographic distribution of organisms, the variation of species in different environments and the interaction of organisms. Such laboratories will, of course, be exclusively for research, and should be equipped with everything requisite for the collection, the study alive and the rearing of organisms.

While the Woods Holl Laboratory provides a home for the first-mentioned investigations, and will, with increased resources, be able to provide still better for them in the future, the needs of the second sort of biology are still imperfectly met. On the middle Atlantic coast there is a series of laboratories that are of value for this work, as at Harpswell, Woods Holl, Cold Spring Harbor, Beaufort and Bermuda. And on the Pacific coast we have the Hopkins Laboratory and that of the University of California. The pressing needs are now for one or more stations on the Gulf of Mexico and the Caribbean Sea—those vast mediterranean seas our failure to investigate whose fauna remains to-day one of the great reproaches to American zoology. Every zoologist who is more than half a zoologist will be glad to see this reproach removed.

In Europe individual enterprise or university initiative backed by government support has established a magnificent chain of biological research stations reaching from Tromsö, Norway, and even the White Sea, along the North Atlantic, the Baltic and North seas, the Irish Sea, the Channel, the Bay of Biscay, and the Mediterranean, Adriatic and Black seas. In this country, where the idea that a university should be primarily a research institution is slow in taking root, we can not look for the establishment of such stations far from university centers. The founding of the Carnegie Institution leads us to hope that now America can do her plain duty in the investigation of our adjacent tropical seas. Just where these laboratories should be located may be left to the consensus of opinion of zoologists, if such can be obtained. There seems to be a nearly unanimous agreement that the Tortugas are the best place for one of them. Certainly any one looking at the map and seeing their position in the middle of the out-portal of the great breeding ponds of the Atlantic tropical fauna would predict that here would be one of the best places in the world for a marine station. Twelve years ago Mr. Agassiz named it to the writer as the ideal place for a marine station, and every zoologist that has been there since has brought home the same report. So it clearly *is* an ideal spot, and the first tropical marine station should go to the Tortugas.

It is to be hoped that, in addition, the desirability of establishing a marine station at Jamaico, Porto Rico or another of the Antilles may be considered; and while we are planning a chain of marine stations, certainly the island of Grand Manan or the coast of Newfoundland and Puget Sound should be considered. Also, it would be well to have a party to explore in successive years the fauna of Davis Strait, Hudson Bay, Bering Sea and the Gulf of California, and to report on the feasibility of establishing marine stations at those places. But it seems to me the first step is certainly to establish a laboratory at the Tortugas.

C. B. Davenport.

Chicago,
May 13, 1903.

To the Editor of Science: Although somewhat tardy in my reply to Dr. Mayer's query, I am none the less enthusiastically in favor of the establishment of a marine biological laboratory for research in the tropics. There would be certain advantages in having it within the jurisdiction of the United States, which would narrow the choice of site to Porto Rico, the coast of Florida, or the Tortugas. In the region of Porto Rico the island of Culebra seems especially favorable, and the *Fish Hawk* found good collecting also at Mayaguez. Before a laboratory is finally established I think that these localities should be considered carefully. As to the main coast of Florida and the islands immediately adjoining, a laboratory in most localities of this region would be inaccessible and difficult to provision. Moreover, as I can testify, the water there is frequently in bad condition, becoming milky with fine calcareous material from the grinding of the coral sand by the surf.

Dr. Mayer reports the water at the Tortugas to be very pure; and, as there is a government station there, I infer that means is afforded for frequent communication with Key West, which is easily accessible and would furnish a satisfactory base of supplies. Professor Nutting has mentioned the abundant fauna of the Tortugas, but the one point in which the Tortugas seem likely to excel all other localities has not been emphasized, and that is as a place for the study of the tropical *pelagic* fauna.

It was a search for such a place that led the Johns Hopkins party of 1892 to Bimini, which is on the east side of the Gulf Stream. The Tortugas were considered, and rejected on account of the quarantine for yellow fever there at that time. We arrived at Bimini after a storm with the wind blowing from the southwest, and upon rowing out into the Gulf Stream we found an abundance of pelagic forms that more than satisfied our greatest expectations. But after the wind had returned to normal southeast and had been blowing from that direction a week or so we realized that we had selected the wrong side of the Gulf Stream, for there was a com-

plete change in the pelagic fauna within reach of the laboratory, the catch consisting chiefly of larvæ of forms living upon the Bahama Bank. Reports of the Weather Bureau show that, except during the midwinter months, the prevailing winds at the Tortugas are from east to southeast. That is, they blow diagonally across the Gulf Stream toward the station. This, with a reasonable amount of calm weather, would afford ideal conditions for the study of the truly pelagic fauna, which is the most interesting and the least known. Ordinarily one has to go out in a ship to study this fauna, but at Tortugas, as at Bimini, it would be brought to the door of the laboratory by an ocean current, and at the Tortugas there would be the additional advantage that the wind would generally be blowing across the current toward the laboratory instead of away from it.

If a laboratory is established there I shall certainly endeavor to use it, and I hope that its establishment will not be delayed by any idea of great expenditure. Very good work can be done at such a place with very modest equipments.

ROBERT PAYNE BIGELOW.
MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
May 26, 1903.

HAVING spent a season in Jamaica I am disposed to advocate that island with almost unqualified commendations as a site for a research laboratory in the tropical Atlantic.

B. W. BARTON.
JOHNS HOPKINS UNIVERSITY,
May 6, 1903.

SHORTER ARTICLES.

THE ARC OF QUITO.

THE following statement concerning a work of international interest and importance is taken from the *Comptes Rendus, Hebdomadaires, des Séances de l'Académie des Sciences,* tome CXXXVI., No. 14 (6 Avril, 1903).*

* Report presented in the name of the commission charged with the scientific control of the geodetic operations on the Equator. (Commissioners; Mm. Bouquet de la Grye, Hatt, Bassot, Loewy; H. Poincaré, Secretary.)

"The commission formed by the French Academy of Sciences for the scientific control of the geodetic operations on the Equator had a meeting on March 9 to hear the report of M. le Commandant Bourgeois on the work executed during the year 1902." Unhappily, the progress of the work has not been as rapid as was expected last year when the previous report was made. This delay has resulted from two prinicipal causes, the first being the exceptionally unfavorable meteorological conditions. The summits of the mountains were constantly covered with clouds or mist which rendered observations impossible.

Lieut. Perrier remained three months at the station on Mirador, at an altitude of 4,000 meters, and was constantly in the clouds. During his whole stay incessant rains and a furious wind prevailed except at rare intervals. The other parties encountered the same difficulties. At Tacunga, M. Maurain was only able to observe at rare intervals. At Cahuito, M. Lacombe passed many days in the mist and snow without being able to obtain a single observation. M. Lallemand had charge of the reconnaissance and signal building and encountered many obstacles. These unfavorable conditions appeared to have an exceptional character which the reconnaissance could not make known in advance. Ordinarily the season of rain is shorter, and even in the worst months observations are sometimes possible during many hours of the day. Is it possible that the persistent bad weather should be ascribed to the recurrence of volcanic activity which showed itself in the whole of South America after the catastrophe at Martinique?

The volcanoes of the eastern Cordilleras, which ordinarily emit a little vapor, threw out columns of smoke on many occasions, and there were lava flows in the western chain.

Strong earthquake shocks were also felt. These volcanic manifestations did not directly delay the work, but perhaps they were connected with the meteorological conditions which proved to be so serious in delaying the operations.

The second cause of delay was the continued

destruction of the signals by the Indians, and also by the whites. These ignorant people imagined that these signals were erected to mark the location of treasure and they not only threw down the signals but they dug deep in the soil all around and destroyed the marks which had been established in order to recover the exact location of the stations. The warning of the government, the commands of the bishops and sermons of the priests were equally unable to prevent this destruction.

We hope that, thanks to the efforts of the authorities and, above all, to the zealous efforts of the president of the republic, such incidents will become unusual. The destruction of signals in a country where communication is so difficult always entails long delays, but, above all, to find on many occasions that the marks had been destroyed after the position of the station had been exactly determined was most disastrous, as it entailed the reoccupation of all the stations from which the one destroyed had been observed. Thus the destruction of the marks at Chujuj, situated in the center of a polygon, made it necessary to reoccupy the four surrounding stations.

Certain signals have been destroyed three times and almost every report from Captain Maurain mentions other cases of destruction. The most unfortunate of these incidents was the simultaneous destruction of the marks at Panecillo, where one of the principal astronomical stations was located, and of the geodetic station of Pambamarca. The geodetic station had not been occupied, and it was necessary to redetermine the astronomical azimuth of the side Panecillo-Pambamarca, a primary operation which had been completed in 1901.

There is great anxiety about the safety of the stations Zagroun and Lanlanguzo at the ends of the line, from which the work to the south will be extended. If these stations are destroyed it will be necessary to redetermine many other stations. Native officers attached to the expedition have been sent to this line to watch the stations and impress on the local political authorities the importance of preserving it from destruction.

In spite of all these difficulties, we have the satisfaction of stating that the operations have been conducted in such a way as to furnish every guarantee of precision. We regret the delay of some months which will undoubtedly increase the expense, but the scientific value of the work will leave nothing to be desired.

Base Measurement.—Two base lines were measured in 1901, one in the center at Riobamba, measured first with a bi-metallic bar and afterwards with the Jäderin wire; the other on the north at El Vinculo measured only with the Jäderin wire. These measurements were made during the preceding year, but since then they have been reduced. A third base will be measured at Payta in the southern section of the arc at the close of the operations.

Astronomical Observations.—The necessary observations have been entirely completed. The latitude of Tulcan (principal station) was determined in February; the determination of the difference of longitude, Quito-Tulcan required much time on account of unfavorable weather; the evenings of the exchange of telegraphic signals, comprising two entire evenings with four joint determinations at the two stations, two joint half evenings, plus five evenings with two determinations at one station and only one at the other. The computation of these observations has not been completed, but the results appear satisfactory. The exchange of observers was not practicable, but MM. Maurain and Perrier determined their personal equations at Quito and will redetermine them when they meet again. The resulting latitudes are as follows, all the computations having been made:

Payta	−5° 05′ 08″.6
Riobamba	−1 40 00 .9
Panecillo	−0 13 51 .1
Talcan	+0 48 25 .6
Total amplitude of arc	5° 53′ 34″.2
Amplitude of northern section	2 28 26 .5

The northern section includes two secondary astronomic stations, Tacunga and Ibarra. Captain Maurain decided first to determine the longitude between the principal station at Panecillo and the observatory at Quito, so as to take advantage of the continuous presence

of M. Gonnessiat at the observatory for the determination of the longitude of the secondary stations. For this purpose M. Maurain, before starting, determined his difference of personal equation with M. Gonnessiat and then determined the difference of longitude between Quito and the two secondary stations, on three evenings, using one chonograph installed at Quito which registered the observations of the two observers. Telegraphic communication was made without a relay. The latitude of Tacunga was determined on four evenings with a meridian circle and the preliminary general mean is 0° 56′ 00″.97. The results of the observations for altitude at Ibarra are not yet reduced.

Geodetic Operations.—The astronomical observations have been completed and the unexpected delay has all been in the geodetic work.

The northern section from the side Zagroun Lanlanguzo includes thirty stations between the two base lines, and of these thirty stations only six or seven remain to be occupied.

The northern observing party has completed the polygon which encloses the El Vinculo base line, except the central station Machines, while the southern party, starting from the line Zagroun-Lanlanguzo to the south of Riobamba, has reached the line Pichincha-Pambamarca, to the north of Quito. Unhappily we must expect to find difficulties at the remaining stations, similar to those already encountered, on account of the climatic conditions.

The azimuths already determined show a very satisfactory agreement and the mean error of closure of the triangles already computed is about one second.

Zenith Distances.—In general, it is not possible to measure simultaneous reciprocal zenith distances, but reciprocal zenith distances have been obtained between all the stations. The preliminary examination of these observations shows that they are very accordant and the refraction seems suitably constant, which fact the steadiness of the objects observed had indicated in advance. This is confirmed by the rigorous simultaneous measures made by M. Maurain at Pambamarca and by M. Gonnessiat at Panecillo. Under these conditions it is possible to execute good geodetic leveling.

Latitudes of the Third Order.—The attention of the observers was called to the necessity of obtaining observations for latitude as often as practicable.

The theodolite with micrometers could not be used, and it was very difficult to transport the meridian circle. After considerable progress had been made the observers received accessories which enabled them to use the theodolite with micrometers in observations for latitude. Captain Maurain observed a secondary latitude at Tacunga with the meridian circle and then made observations for latitude with the theodolite to ascertain the precision to be expected when that instrument was used. The result was sufficiently good to warrant its use for this purpose in the mountains. There is always a systematic difference between observations on north stars and those on south stars, but the errors from many successive nights are always very small.

The observers will soon receive two Claude Driencourt apparatus; this apparatus, which has been described in the *Astronomical Bulletin,* Vol. XVII., gives results of great precision and is very portable, and it can be utilized at the geodetic stations which remain to be occupied, especially in localities where gravity observations will be made. A great number of observations for latitude of the third order have been made with the theodolite, one to the south of Riobamba, one near Riobamba, two around Tacunga, three around Quito (Pambamarca, Pichincha, Corazon) and four around the northern base line.

Gravity.—This portion of the work has not made much progress. The station at Riobamba is reduced, but it still needs the accurate determination of the rate of the sidereal clock. No other observations have been made. It is still undecided what instruments should be used at the secondary stations. The Sterneck pendulum does not appear to present as great advantages as it was at first believed to possess. M. Maurain

thought of using the new thermo-barometric method which has been used on the Atlantic Ocean, but it has been justly stated that this method would not give results sufficiently precise. However, the chief of the expedition has not lost sight of this important question, and we can be assured that it will not be neglected.

Leveling of Precision.—The completion of the work on the railroad towards the plateau between the Andes permits the levels between Guayaquil and the base line at Riobamba to be determined with much greater facility than was possible when the arc measure was begun.

Topographic Work.—A map on a scale of 1/500,000 will be made of the whole intermountain region and special maps on a larger scale have been made in certain localities.

Magnetic Observations.—Magnetic observations have been made at nearly all the stations. They are not yet reduced.

Studies in Natural Science.—Dr. Rivet has continued his studies relating to the natural sciences and has made a number of additions to the museums. He has undertaken the study of the anthropology of the Indian races in this intermountain region.

The following is the program of work during the year 1903:

1. The completion of work on the northern section.

2. The geodetic observations on the southern sections and more or less of the section Riobamba-Cuença, comprising besides azimuth observations the determination of the latitude 'a la seconde ronde' at each station if possible.

3. A secondary latitude at Cuença and the difference of longitude Cuença-Riobamba (or Cuença-Quito) if telegraphic connection between the former stations can not be made without delay.

4. The magnetic observations as heretofore.

5. The beginning of the levels of precision.

There remains for the following years the geodetic work on the section Cuença-Payta, the pendulum observations, and the connection, if possible, by geodetic observations of the island of Puna, with the meridional chain of triangulation, with a complete astronomical station on Puna.

Isaac Winston.

QUOTATIONS.

THE NEW YORK STATE SCHOOL OF FORESTRY.

When New York established a School of Forestry, to make sure that it should not fall into the hands of politicians and be exploited for 'what there was in it,' it was lodged under the shelter of Cornell University. It was deemed advantageous to make this arrangement for other reasons also, and particularly in order that the teachers and students should have access to the library and laboratories and lecture rooms of the university proper, where the cognate sciences of botany, chemistry, mineralogy and various kinds of engineering are taught. The university chose a professor of forestry of the highest repute, Mr. E. B. Fernow, and placed him in charge of the important work which had been assigned to it, and the state set apart certain forest lands which it owned, in order to impart the needed instruction to students. The annual reports of Professor Fernow have been published and circulated at the state's expense, and have been highly praised by all competent to form an opinion. We have never seen an unfavorable comment upon them by any expert in forestry.

The state also made an annual appropriation for its School of Forestry. That of 1902 was for $10,000, where $30,000 had been asked for. This year the appropriation was vetoed by the governor, and now the attorney-general has been requested by certain summer residents of the Upper Saranac Lake region to bring an action to annul the 'grant of forest lands to Cornell University'—so the dispatches read. Naturally, the newspapers have fallen into the habit of considering the university the beneficiary of both the grant and the appropriation. This is not the first time that the mistake has been made, although the fact is that the state is indebted to the university in respect of this school. The university has no pecuniary interest in the School of Forestry that is not common to all citizens of New York. What is at the bottom of this rage against the School of Forestry it is difficult to see, unless it may be the mere objection of campers, hunters and summer residents. The objectors, whoever they may

be, say that the state constitution is violated by the removal of timber from the ground 'for purely commercial purposes.' There has been no removal of timber for any such purpose. If the science of forestry is to be taught at all, it must be done by first clearing some portion of the land for the reception of new growth. The timber removed would naturally be sold on the general ground of economy and for the special purpose of reimbursing the state for the cost of cutting and hauling. The only question which now confronts the state is that of continuing the scientific instruction in forestry which it has begun or of abandoning it.—The N. Y. *Evening Post.*

AGE OF GERMAN UNIVERSITY PROFESSORS.

DR. F. EULENBURG, privat-docent in the University of Leipzig, has published in the *Jahrbücher für Nationalökonomie und Statistik* a lengthy article dealing with the age of the active full professors in the universities of Germany as also of the German universities in Austria and Switzerland. It is practically exhaustive, only about two per cent. of the complete data being wanting, so that it covers 1,288 professors for the winter term of 1890–91, and 1,429 for the winter term of 1901–02. According to these statistics, the average age of the full university professors at present is 53.4 years, which is two years above what it was a decade ago, when it was 51½ years. The highest average age is found at the ten Prussian universities, where it is 54.5 years, and the lowest average in the three universities of Switzerland, where it is 51.8. It is significant that the smaller universities exhibit a smaller average than the larger; this is explained by the fact that usually men do not gain an entrance into the faculties of the larger until they have been tried and found approved in the smaller. In different departments the average varies considerably. In the case of the 201 theological professors it is 54.2; of the 226 law professors, 54.2; of the 295 medical professors, 54.8; of the 707 men in the several departments of the philosophical faculty, 53.1. That the average among the medical men should be the highest is readily explained by the fact that the rush to this department is especially great, and that the number of assistant professors and privat-docents is very large. On the other hand, the law faculties have not been attracting so many candidates, and the chances for earlier promotion are accordingly greater. The highest averages are reported from Berlin, Königsberg, Munich and Leipzig; which can readily be explained in the case of the first, third and fourth, as these leading universities are the Ultima Thule of the German savant's ambition. The youngest full professors are found in Bonn, Heidelberg, Vienna and Strassburg, in the non-theological faculties, and in Tübingen, Marburg, Innsbruck, Erlangen and Giessen in all departments. There are only two full professors under thirty, both in the law department, one in Tübingen and the other in Bern. About four per cent. of the professors continue in the harness after they have passed their seventieth year, but it should be remembered that in Austria, as in the German provinces of Russia, professors are retired by law when they reach this age. Eulenburg suggests that the German states pass a law giving the incumbent of an academic chair the right to retire at the age of sixty-five with a pension, and making this compulsory, except in rare cases, at the age of seventy, but in each instance, in the latter case, making the incumbent Professor Emeritus and giving the 'Lehrauftrag' to a younger man. This, he declares, would be justice to both students and professors. His discussion has an added interest when compared with the paper published in 1876 by Laspeyres on the same subject.—*Medical News.*

PROGRESS OF THE CONCILIUM BIBLIOGRAPHICUM.

DR. HERBERT HAVILAND FIELD is now in this country in connection with the *Concilium Bibliographicum,* and will visit various institutions, in order to report in person on the progress of the concilium, and to enter into communication with all who are interested in bibliography in the various lines of natural history. His address during his stay in America will be 106 Columbia Heights, Brooklyn, New York.

The turning point has been reached in the history of this really great undertaking. The chief support has come through the generosity of the Swiss government, and it is hoped that the American government and some of the leading American institutions will unite in placing this work upon a secure foundation. Naturally one of the first questions asked is how the undertaking is regarded abroad, and why it should receive the united support of workers in the various lines of natural history. There are several striking proofs of the esteem in which the concilium is held on the continent. Through the death of Professor Carus, who has given his entire life to bibliography, almost without remuneration, a vacancy has occurred which the concilium has been invited to fill. It is a matter of continuing the zoological bibliography conducted by one who has been universally acknowledged to be a master in his subject and which reaches back without interruption to the year 1700. Before agreeing to undertake to carry on this work, the concilium is brought to face obligations which it can not fulfill without new support. At the same time the botanists on the continent, impressed with the thoroughness of the work of the concilium, at the international conference held in Leiden on April 16, voted to place the editorship of the well-known botanical bibliography in the hands of the concilium, as soon as funds could be obtained for doing the work. In both these cases, zoology and botany, it is only a small portion of the entire expense that is needed, but failure to obtain this comparatively small aid will make it impossible for the concilium to undertake these new duties. Meanwhile a number of European geologists are awaiting the results of these negotiations, with a view to establishing a geological section of the concilium similar to that of other parts of the institution. This endorsement from workers in three entirely separate fields, arrived at entirely independently, is so striking that it needs no further comment. Never was the conjunction of circumstances for securing a thoroughly adequate bibliography of an entire group of natural sciences more marked. It is hoped, therefore, that the effort that Dr. Field is now making here will be crowned with success.

The special needs of the concilium are, in the order of importance: $3,500 for improvements in the Zurich plant, especially for the acquisition of a linotype printing machine; $4,000 for the liquidation of an accumulated debt; and at least $1,000 additional for current expenses.

Dr. Field especially invites criticisms and suggestions upon the work as it is now being carried on. From several persons the criticism has been made to the present writer that the cards accumulate too rapidly and are somewhat difficult of arrangement. This difficulty, in the nature of *embarras de richesse,* has been felt in many laboratories. It will be readily obviated, first, by the introduction of the guide cards which are supplied by the concilium, and which make the arrangement of the titles a purely mechanical matter; second, it is proposed, wherever desired, to limit the number of cards sent out which relate to certain local faunæ and are of purely local interest. These, and any other matters of criticism which may arise, Dr. Field, as director of the concilium, will be glad to receive and carefully consider as suggestions for improvement of the service. All those who are using the cards appreciate that, whatever criticisms as to details may be made, the concilium is doing a magnificent work, a work far surpassing in accuracy and fulness and readiness of arrangement that which has been done or is now being done elsewhere. Many of the former critics and opponents of the concilium are now recognizing its superiority, and it is certainly to be most earnestly desired that the United States should strongly support an undertaking which has been conceived and carried out only through the persistence, energy and devotion of an American.

Henry Fairfield Osborn.

CENTENNIAL CELEBRATION OF THE BIRTHDAY OF JUSTUS VON LIEBIG.

On the twelfth of May, by invitation of the New York Section of the Verein Deutscher

Chemiker, the members of the American Chemical Society, the Society of Chemical Industry and the Chemists' Club participated in a celebration in memory of the illustrious investigator and chemist, Justus von Liebig, who was born one hundred years ago.

The societies met in the assembly hall of the Chemists' Club and listened to addresses by Dr. Ira Remsen, president of Johns Hopkins University; Professor Wm. H. Brewer, of Yale; Dr. Carl Duisberg, vice-president of the Verein Deutscher Chemiker and managing director of the *Farbenfabriken* of Elberfeld, Germany.

The exercises were opened by Dr. Hugo Schweitzer, chairman of the Verein, who welcomed the assembly and foreign guests in a very appropriate address, and introduced the speakers.

Dr. Remsen outlined the early life of Liebig, mentioning his unpromising inaptitude for study at school, which resulted in giving it up and devoting himself to chemistry; his first interest in which was aroused by the study of colors and dye-stuffs. Later, while at a country fair, he saw an exhibition of Pharaoh's serpents, accompanied by some chemical operation connected with their preparation which led eventually to his study and investigation, while attending the lectures of Gay Lussac at Paris, of the cyanides, cyanates and fulminates. This work resulted in his introduction to Gay Lussac, who admitted him to his private laboratory. He was appointed a professor at the University of Giessen, in his twenty-first year, 1824, where his laboratory was of the crudest character, not much better than a barn without flooring; but from this modest beginning, with only six or seven students, his work grew and his reputation spread; a new laboratory was built and students came to it from all quarters.

During the twenty-eight years at Giessen the activity of Liebig and the work he accomplished were enormous; and he can be truly considered the greatest chemist of that time. His publications in scientific journals amounted to more than two hundred papers, in addition to his works on agriculture, organic chemistry and analysis; besides acting as editor of several scientific journals.

Coming to personal reminiscences of the time when he attended the lectures of Liebig at Munich, Dr. Remsen described the difficulty he experienced as a student in attempting to harmonize the old system as taught by Liebig, with the new as taught by his assistant, Volhard. Speaking of his methods, he said that all Liebig's lectures were profusely illustrated by experiments, many of them so elaborate as to be unthought of in the present-day lecture room—metallurgical experiments requiring wind furnace, and many others which the speaker said he would now hardly believe could have been done on the lecture table if he had not preserved his note-book filled with rude drawings of all the apparatus used.

Liebig was fond of a little dramatic effect, and took some care to bring his lectures to a climax with the most effective experiment, whether with a big flash of flame or an explosion or otherwise; and while the present method is more severe and straightlaced, the speaker said he was not certain that the impressions made and the train of thought aroused by Liebig's method were not very effective.

It was extremely difficult to get admission to Liebig's laboratory as a student; in fact, it was one of his conditions, on accepting the professorship at Munich, that he should not give his time or attention to students. In appearance, Liebig was large of stature and of fine bearing; one of nature's noblemen, but very emphatic in berating his assistants when the experiments went wrong, his language on such occasions being more remarkable for condensed energy than for rhetorical elegance.

Professor Brewer, who is the oldest living pupil of Liebig in this country, and who has been his devoted follower in the line of agricultural chemistry, told of his enthusiastic desire to study under him, aroused by reading a translation of his work on agriculture in 1846. A few years later he went abroad, and with letters of introduction went to Munich. Here he found Ogden Rood, afterward pro-

fessor of physics at Columbia University, who offered at once to introduce him to Liebig, and assist in every way toward the desired end. But Rood advised him not to use his letters of introduction; not to call Liebig 'professor,' but 'Herr Baron'; to have plenty of assurance, and not to spare flattery. With this preparation the introduction was brought about and Brewer stated his mission. Liebig assured him that he would do better to go somewhere else. He said: 'I will give you no attention; no attention.' This assurance met every advance until finally the speaker said: 'I told him I have come three thousand miles to sit at the feet of the greatest teacher of chemistry in Europe and I am going to remain here.' 'Well,' said Liebig, 'see Mr. Meyer.'

He saw 'Mr. Meyer,' and a place was set apart in the laboratory for the new student, who remained there a year, but actually received practically 'no attention,' except when he showed some organic crystals to him which had the appearance of potassium nitrate, and were so pronounced by Liebig on sight. The effort to convince him that they were organic was followed by a sound berating for 'contradicting,' which was later followed by demonstrating to the great professor that no contradiction had been intended, and that the crystals were in fact 'very peculiar.' Professor Brewer's address was full of personal interest and was followed with the closest attention.

Dr. Carl Duisberg read a paper describing the influence of Liebig on chemical industry, his teachings resulting in that knowledge of the importance of scientific method which has so largely displaced the 'rule-of-thumb' man by trained chemists in all the great chemical industries of Germany; and more or less in other countries. Liebig's influence was exerted chiefly on the organic chemical industries, and much of their progress is due to his activity and energy while at Giessen.

"A staff of his pupils making their way to all quarters of the globe disseminated his ideas in assisting agriculture and the chemical industries, and as the first systematic teacher of laboratory methods, the credit is justly due him for an influence which can hardly be measured or described."

Among those assembled to honor the memory of the great chemist were Mr. Ivan Levenstein, of Manchester, England, president of the Society of Chemical Industry, and his son, who represents the Levenstein Company, limited, in this country; Dr. Liebmann, also of Manchester; Drs. H. Reisenegger and F. Backe, of the color works at Höchst am Rhein; Dr. Teichmann, of Kuhnheim Works, Berlin; F. Bayer of Elberfeld; W. Haarmann and son of Holzminden, German; also Dr. T. J. Parker, chairman of the American Chemical Society; Dr. McMurtrie, ex-president of the same society; Professors W. H. Hallock and C. E. Pellew, of Columbia University; Charles A. Doremus, William Jay Schieffelin and others.

Durand Woodman.

*THE DALTON CELEBRATIONS AT MANCHESTER.**

The Manchester celebrations in connection with the centenary of Dalton's atomic theory began on Tuesday afternoon, May 19, when Professor F. W. Clarke, chairman of the International Commission on Atomic Weights, delivered the Wilde lecture on the 'Atomic Theory' to the Manchester Literary and Philosophic Society. Addresses were presented on behalf of the Royal Society and the Chemical Society, and a message was received from the Russian Physico-chemical Society. In an admirable discourse Professor Clarke sketched the history of the atomic theory from its first conception in the minds of Greek philosophers down to the present day. He pointed out the directions in which the atomic theory would probably develop, but declared that the problem of matter would never be solved until the atomic weights of the elements had been finally settled. "Who," he asked, "will establish the Dalton Laboratory for pure research, and so give the work which he started a permanent home?"

In the evening the Literary and Philosophical Society gave a dinner, at which the prin-

* From *Nature*.

cipal guests were Professors Clarke and van't Hoff, Professor A. E. Armstrong, Mr. Brereton Baker, Professor P. F. Frankland, Mr. Vernon Harcourt, Dr. Harden, Sir James Hoy, Professor Kipping, Dr. W. H. Perkin, Sr., Sir William Ramsay, Professor Emerson Reynolds, Sir Henry Roscoe, Professor Smithells, Dr. Scott, Professor Thorpe and Professor Tilden.

In proposing the toast of the evening, the 'Wilde' medallist—Professor Clarke—and the Dalton medallist—Professor Osborne Reynolds—Sir Henry Roscoe said that Dalton's atomic theory and Joule's discovery of the mechanical equivalent of heat reflected more distinction on Manchester than the city's association with the cotton industry or with the Ship Canal.

On Wednesday morning a special meeting of the Owens College Chemical Society was held to offer an address to the great Dutch chemist, J. H. van't Hoff, now professor at the Berlin University. Professor Dixon was in the chair. The address was presented by Mr. Norman Smith, a former student under Professor van't Hoff. The professor, who was enthusiastically received, said the question was often asked, nowadays, whether the atomic theory had not outlived its utility. His reply was that, in dealing with natural phenomena, with states of unstable equilibrium, the atomic theory was indispensable for essential explanations. He had come to regard the conception of the carbon atom as the center of a tetrahedron as childish, but it contained the germ of a profound truth, the solution of which must be left to the future. He suggested that valency was due to an equilibrium. The four mutually repellent 'electric atoms' of Helmholtz were kept in equilibrium by their attraction for the carbon atom at the center.

Later in the morning Earl Spencer, Chancellor of the Victoria University, conferred the honorary degree of Doctor of Science on Professor Clarke and Professor van't Hoff, who were presented by Professor Dixon. After the conclusion of the ceremony Professor van't Hoff laid the first stone of the proposed extension of the Owens College Chemical Laboratories, and was presented, as a memento of the occasion, with a silver trowel by the College Chemical Society. The celebrations were concluded by a soirée held at the Owens College on Thursday night, when Dr. Harden gave an interesting account of John Dalton, and many Dalton relics were exhibited by the Manchester Literary and Philosophical Society, Professor H. B. Dixon, Mr. Theodore Neild, Mr. G. W. Graham and Mr. G. S. Woolley.

TRIGONOMETRIC SURVEY OF BRAZIL.

THE Brazilian government has provided for the mapping of its territory on a scientific basis. Last year the congress appropriated the necessary funds for commencing the work, and a commission of which Colonel Francisco de Abreu Lima is President, was to leave Rio early in May for the state of Rio Grande do Sul to make a reconnaissance of the first zone to be triangulated.

The scheme as far as at present outlined, includes the measurement of bases at Porto Alegre and Uruguayana, and the connection of these two cities by triangulation. This will give an arc of about six and one quarter degrees of longitude in about latitude 30° south.

The Superintendent of the U. S. Coast and Geodetic Survey has been requested by the commission to supervise the preparation of the necessary tapes and accessories for the measurement of the bases.

SCIENTIFIC NOTES AND NEWS.

DR. W J MCGEE has been appointed chairman of the committee of the International Geographical Congress of 1904, succeeding General A. W. Greely, who has resigned owing to ill health and the pressure of official duties.

THE University of Marburg has conferred its honorary doctorate on Mr. Geo. F. Kunz, of New York City.

M. HENRI BECQUEREL, Paris, and Professor A. Righi, Bologna, have been elected honorary fellows of the Physical Society of London.

DR. MAX NOETHER, professor of mathematics at Erlangen, has been elected a foreign member of the Academy of Sciences at Buda Pesth.

Lady Huggins and Miss A. M. Clerke have been elected honorary members of the Royal Astronomical Society.

The commencement address at the graduating exercises of the Worcester Polytechnic Institute is to be given by O. H. Tittmann, director of the United States Coast and Geodetic Survey.

At a special meeting of the Physical Society, London, held on June 5, at University College, Professor E. Rutherford, of McGill University, read a paper on radioactive processes.

Mr. Andrew Graham, who has for nearly forty years held the office of chief assistant at the Cambridge Observatory, is retiring at the age of eighty-eight.

Dr. Otto Bütschli, professor of zoology and paleontology at Heidelberg, has celebrated the termination of his twenty-fifth year of service as professor at the university.

Dr. William Osler, professor of medicine at the Johns Hopkins University, sailed on May 29 to England, where he will remain until the end of September.

The National Geographic Magazine states that Dr. A. Graham Bell resigned the presidency of the National Geographic Society at a meeting of the board of managers, on May 15. Dr. Bell stated that owing to the pressure of work he found it impossible to give to the society the thought that the position of president demanded. The resignation of President Bell was accepted by the board with profound regret, to take effect on the election of his successor. Dr. Bell was appointed chairman of a committee of three to consider and nominate a successor. The other two members of the committee, appointed by the president, are Dr. Willis L. Moore, chief U. S. Weather Bureau, and Mr. G. K. Gilbert, U. S. Geological Survey. As no election will be made until the fall, Dr. Bell will continue as president of the society for some months.

A statue of the chemist, Kekulé, by the sculptor Heinz Everding, has been unveiled this month at Bonn.

John F. Hicks, assistant botanist of the Ohio Agricultural Experimental Station, died at Wooster, Ohio, on June 1.

Dr. Milan Sachs, a young Viennese physician, has died from plague at Berlin. He had studied the disease at Agram and other Balkan cities, and went to Berlin a few weeks ago to continue his researches at the Bacteriological Institute, where he became infected.

M. Gaston Dubois Desaulle, who was on a voyage of exploration to the West Coast of Africa, has been killed by the Galadils.

We regret also to record the deaths of Dr. Friedrich Deichmüller, professor of astronomy at Bonn, and of M. François Crépin, director of the Botanical Garden at Brussels.

There will be a civil service examination on July 15 for the position of chief of the Division of Pharmacology, Bureau of Public Health and Marine Hospital Service, the salary of which is $3,600. There will be no scholastic tests, and competitors will not be required to be assembled for examination, which will be based on technical training, professional experience and publication.

There will also be a civil service examination on June 3 for the position of illustrator in agrostology in the Bureau of Plant Industry, Department of Agriculture, with a salary of $720.

Mr. Carnegie's gift of $1,000,000 to the four national engineering societies and the Engineers' Club for a building has been accepted at a meeting of the representatives of the five organizations, and plans have been made for a joint committee consisting of three members from each organization. This committee will prepare plans for a building to be erected on Thirty-ninth St. Efforts are being made to secure funds for the purchase of the land, and we learn from *The Electrical World* that a number of subscriptions have been received by the American Institute of Electrical Engineers including $5,000 from Dr. Elihu Thomson and the Westinghouse Electrical Company, $2,000 from Mr. Frank S. Sprague and $1,000 with a contingent $1,500 from Mr. J. G. White.

THE College of Physicians of Philadelphia will remove from its present building on Thirteenth and Locust Sts., and will erect a new building on Twenty-second St.

THE corner stone of the new observatory at Amherst College will be laid at noon on June 23, in connection with the commencement exercises.

THE steamship *Gauss* of the German Antarctic Expedition, under the command of Professor von Drygalski, has arrived at Natal on the way to Cape Town.

THE forty-first Annual Convocation of the University of the State of New York will be held in the Senate Chamber, Albany, June 29 and 30.

IT is stated in *Nature* that the annual congress of the Southeastern Union of Scientific Societies will be held at Dover, June 11–13. On Thursday evening, June 11, the president-elect, Sir Henry H. Howorth, F.R.S., will deliver the annual address. The following papers will be read on June 12: 'Atmospheric Moisture as a Factor in Distribution,' by Mr. A. O. Walker; 'Experiences of Leprosy in India,' by Dr. Jonathan Hutchinson, F.R.S.; 'The Diminution and Disappearance of Southeastern Flora and Fauna within the Memory of Present Observers,' by Captain McDakin and Mr. Sydney Webb; 'The Seedlings of Geophilous Plants,' by Miss Ethel Sargant; 'The White Chalk of Dover,' by Dr. Arthur Rowe; 'A Late Keltic Cemetery at Harlyn Bay,' by Rev. R. Ashington Bullen. On June 13 Mr. A. T. Walmisley will lecture on 'International Communication.'

THE Lake Laboratory of the University of Montana will open on July 13 and will continue for five weeks, after which opportunity will be given for research work. Professor M. J. Elrod is director of the station and has charge of the work in botany and entomology. Mr. Morris Ricker has charge of zoology and photography and Mr. P. M. Silloway of ornithology and nature study. The field laboratory is located on the bank of Swan River at its outlet into Flathead Lake. This location affords a harbor for boats and a camping site for the tents of those attending. The adjacent region contains forests, ponds, lakes, swamps, cultivated fields, mountains, rivers and ravines. It is rich in animal and vegetable life. The lake offers opportunities for collecting, and presents some beautiful scenery. East of the lake the Mission range comes abruptly to the water's edge. The range slopes from the Swan River on the north to the high peaks, ten thousand feet, at the southern end, and its scenery is wild, rugged and grand, truly Alpine in character. West of the lake are the Cabinets. Near the station Swan Lake, Rost Lake, Echo Lake, and other waters, are easily accessible. Daphnia Pond, a few minutes' walk from the station, is rich in pond life, while Estey's Pond, about as far again, is fully as productive. The Swan range is easily accessible from the station, and Alpine summits are annually visited. The station is not difficult of access. The stage and boat rides are easy, with charming scenery constantly in view. The building is a convenient out-door laboratory, with tables for a dozen students. The station work has entirely outgrown the building. Many of the lectures are given out of doors in the yard, and the fine summer weather permits of much laboratory work out of doors.

LORD AVEBURY read a paper at the meeting of the Geological Society, London, on May 27, on the formation of mountains. According to the report in the London *Times* he said that experiments had been made long ago by Sir J. Hall, and afterwards by Daubree, Ruskin, Cadell and others, by arranging layers of cloth, clay, cement, etc., and studying the folds and fractures which resulted when they were compressed. In all these experiments, however, the pressure was in one direction only, whereas it was obvious that if mountains were due, at any rate in part, to the contraction of the earth, in nature the contraction and consequent pressure took place from all sides. Lord Avebury said that he, therefore, provided himself with a square case compressible on all four sides at once. In the central space he arranged layers of sand, cloth, etc., and compressed them, thus throwing them into folds. He then took in each experiment

four casts in plaster of Paris, beginning from the top, and these casts were exhibited to the society. They presented an interesting analogy to actual mountain districts, though, of course, they did not show the results of subsequent denudation due to rain and rivers. It had long been observed that mountainous districts showed two sets of lines at right angles to one another. Any one who would glance at a map of Scotland would see this clearly. One set was represented by the Great Glen, with the lochs and valleys parallel to it, such as the Minsh, Loch Awe, Loch Fine and many others; the second series at right angles to it by Loch Shin, Loch Moree, the Sound of Mull, etc. This characteristic of mountain regions had long been known, and there had been discussions as to whether the folds were simultaneous or successive. Lord Avebury's casts showed this feature very clearly, and it was evident that the cross foldings took place simultaneously.

Investigations of artesian and other underground waters and of springs will be conducted in the following states during the coming field season: *Maine*—Professor W. S. Bayley will collect data in regard to deep wells by correspondence and by field work in the islands along the coast. He will be assisted by Mr. W. C. Washburn. *New Hampshire*—The occurrence of underground waters and of springs will be studied by Mr. J. M. Boutwell, who has already entered into communication with well owners at many points in the state. *Vermont*—Work on underground waters and springs in this state will be conducted by Professor George H. Perkins in connection with his work as state geologist. *Massachusetts and Rhode Island*—These states have been divided into two districts, the northern district including the northern and western portions of Massachusetts, and the southern including southeastern Massachusetts and Rhode Island. The wells and springs of the former will be investigated by Mr. Lawrence LaForge, and those of the latter by Professor W. O. Crosby. *Connecticut*—The services of Professor H. E. Gregory have been secured for the investigations of underground water and springs in this state. He will probably have one or more assistants in the work. *New York*—Two problems are under investigation in this state; the first is an investigation of the geology and water resources of Long Island by Messrs. M. L. Fuller, A. C. Veatch, W. O. Crosby, and several assistants; the second relates to the occurrence, composition and economic value of the spring waters of the state. The latter investigation will be conducted by Mr. F. B. Weeks, in cooperation with Dr. A. C. Peale on the statistical and chemical sides of the problem. *New Jersey*—The work in this state is being conducted in cooperation with the State Geological Survey. It is expected that the artesian well investigations will be completed during the summer, and that a report will be prepared by Mr. G. N. Knapp during the fall and winter. *Georgia*—Mr. S. W. McCallie, assistant state geologist, will probably complete his investigations and prepare a report on artesian and underground waters in the state. *Alabama*—Professor E. A. Smith, state geologist, will continue his investigations of the occurrence of underground waters. *Mississippi*—The work in this state, which has been going on for some time, will be continued by Mr. L. C. Johnson. *Kentucky and Tennessee*—Dr. L. C. Glenn will undertake an examination of the portion of the Mississippi embayment area lying within the limits of these states, with the special object of determining its underground water resources. *Arkansas*—The investigations in this state consist of correspondence with well owners and drillers and of field work along the contact of the Paleozoic rocks with the embayment deposits in the northern part of the state. *Missouri*—Professor E. M. Shepard will carry on investigations relating to deep wells and springs, with a view to preparing a report at an early date. *Iowa*—Professor W. H. Norton will continue his studies on deep wells, and will prepare a report on the artesian waters of the state. *Minnesota*—Professor C. W. Hall will complete a report on the water resources of Minnesota, and will probably investigate new developments along similar lines, as they occur. *Wisconsin, Illinois and Upper Michigan*—The

investigations in these states will cover all those areas in which artesian waters are known to occur, as well as adjacent portions of Illinois and the Upper Peninsula of Michigan. Mr. A. R. Shultz will have charge of the work and will probably have one or more assistants. *Michigan*—The work in this state is conducted in cooperation with Dr. A. C. Lane, state geologist, the field work being in charge of Mr. W. F. Cooper, who will spend a considerable part of the summer in investigation of the underground waters of the state.

UNIVERSITY AND EDUCATIONAL NEWS.

AT the meeting of the board of trustees of the Leland Stanford, Junior, University, held on June 1, Mrs. Leland Stanford resigned and surrendered all the powers and duties vested in her by the terms of the grant founding the university, under which she had complete control. That control is now vested in the board. Mrs. Stanford will be elected a trustee, and will be elected president.

THE total appropriation made to The Pennsylvania State College by the legislature of 1903 and recently approved by the governor was $250,805.55. Of this amount $100,000 is for the purpose of assisting in the erection, equipment and furnishing of a building for the Department of Agriculture, while $150,000 additional are virtually pledged by the attachment of a proviso requiring the trustees of the college to file with the auditor general plans, specifications and estimates satisfactory to him showing that the entire cost of the building and equipment will not exceed $250,000.

THE plans of Messrs. Cram, Goodhue and Ferguson, of Boston, have been accepted for the new buildings of the West Point Military Academy, which are to number twenty-one.

LORD IVEAGH has given £40,000 to Trinity College, Dublin, for building and equipping scientific laboratories.

ACCORDING to the London *Times*, after a great deal of consideration and many consultations with the colleges at Manchester and Liverpool, the council of the Yorkshire College have at last agreed upon the principles upon which the charter for the proposed new Yorkshire University should be based. These are that the Yorkshire College be merged in the university; that the university be founded on a non-federal basis, but that it be empowered to affiliate other institutions; and that the university be governed by a court of governors and by an executive council. Substantial agreement has been arrived at between the three colleges on some important matters, such as that of a common matriculation examination for all the three universities of Yorkshire, Manchester and Liverpool, and provision has been made for a joint board to be constituted from the three universities to deal with such questions. With regard to affiliated institutions, it is provided that attendance at courses of study in such institutions may be accepted by the university in place of such part of the attendance or courses of study at the university as may from time to time be determined. It is considered that the additions to the staff and equipment of the college essential to the proper carrying on of an independent university will require a minimum additional expenditure of about £7,000 a year, while extensive additions will also be required to the college buildings for the proper housing of some of the departments. The coal-owners of Yorkshire have decided to erect a separate building for the mining department, and have collected a sum of £5,500 for the purpose. The council of the college are desirous also of completing the main block of the college, and it is estimated that this would cost about £60,000. Though a canvass for the necessary funds has not yet been instituted, three friends of the college have each promised £5,000, while a fourth has promised £2,000. The Clothworkers' Company of London, who have already proved munificent benefactors of Yorkshire and the Yorkshire College, have added to their previous generosity by offering to transfer to the new university as its absolute property the whole of the buildings and equipment of the textile industries dyeing and art departments, which are at present held in trust by the college for the Clothworkers' Company, and which have cost that company about £70,-

000. Attached to the offer is a condition that these departments shall be recognized as integral parts of the university. The company has also promised to grant in perpetuity to the university for the maintenance of these departments an annual sum of not less than £4,000. This means a gift to the university of a capitalized sum of upwards of £200,000.

ACCORDING to the *Hochschulnachrichten* the attendance at the universities of the German empire last winter was 40,661, of whom 36,652 were matriculated. The number of matriculated students in the Austrian universities was 16,125. The number of students in the German technical schools was 13,049 and in the Austrian schools 6,451. These figures, however, do not include the attendance at the schools of agriculture, forestry, veterinary surgery, mining and commerce. The number of foreigners in attendance at Vienna was 1,386 and at Berlin 1,085. There were last year 1,253 foreigners in attendance at Paris.

THE council of Trinity College, Dublin, has recommended that the senate approve the admission of women to that institution and the abolition of the compulsory study of Greek.

JOINT ceremonies of the inauguration of Dr. John Huston Finley as president of the College of the City of New York and the laying of the cornerstone of the new buildings being erected on the site bounded by One Hundred and Thirty-eighth and One Hundred and Fortieth Streets and St. Nicholas Terrace and Convent and Amsterdam Avenues are being arranged by the board of trustees. The installation ceremonies will take place at 10:30 A. M. on October 1. President Roosevelt and ex-President Cleveland will make addresses. The cornerstone of the new buildings will be laid at 3:30 in the afternoon, and addresses will be made by Mayor Low and others.

REV. H. W. MCKNIGHT has resigned the presidency of Pennsylvania College, at Gettysburg.

PROFESSOR WILLIAM R. WARE, from 1860 to 1881 professor of architecture in the Massachusetts Institute of Technology and since then professor at Columbia University, has retired from active service and will become professor emeritus.

APPOINTMENTS at Cornell University have been made as follows: J. I. Hutchinson and Virgil Snyder, assistant professors of mathematics; J. S. Shearer and Ernest Blaker, assistant professors of physics; W. N. Barnard, assistant professor of machine design; C. S. Hirshfield, instructor in experimental engineering; R. Stevenson and I. Baum, assistants in chemistry; L. O. Veser and R. C. Fenner, assistants in physics.

MR. J. C. PEARSON, A.B. (Bowdoin, 1900), now graduate student at Harvard University, has been appointed instructor in physics and mathematics in Bowdoin College.

MISS IDA EVANS, who was graduated from the Woman's College of Baltimore in 1902, has been appointed instructor in biology in Rockwood College. Miss Bertha May Clark, instructor in physics at the Woman's College, Baltimore, has been awarded the graduated fellowship offered annually to an alumna. Miss Clark will study spectrum analysis and advanced mathematics at the University of Göttingen.

AMONG the twenty-two fellowships awarded at the Johns Hopkins University, the following are in the sciences: Samuel J. Allan, of Montreal, Canada, physics; James Barnes, of Halifax, Nova Scotia, physics; Walter Buckingham Carver, of Stewartstown, Pa., mathematics; August Ernest Guenther, of Sandusky, O., physiology; Elliot Snell Hall, of Jamestown, N. Y., chemistry; Arthur Isaac Kendall, of Somerville, Mass., pathology; Charles Kephart Swartz, of Baltimore, geology; David Hilt Tennent, of Janesville, Wis., zoology; Rheinart Parker Cowles, the Adam T. Bruce fellow in biology.

NINE fellowships have been awarded at Bryn Mawr College, including Carrie Alice Mann, of South Weymouth, Mass., mathematics; Lillian Cohen, of Minneapolis, Minn., chemistry; Ellen Terelle, of Minneapolis, Minn., biology.